VOL. XVIII. No. 7 JULY 1933

MECCANO MAGAZINE

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(see page 494)

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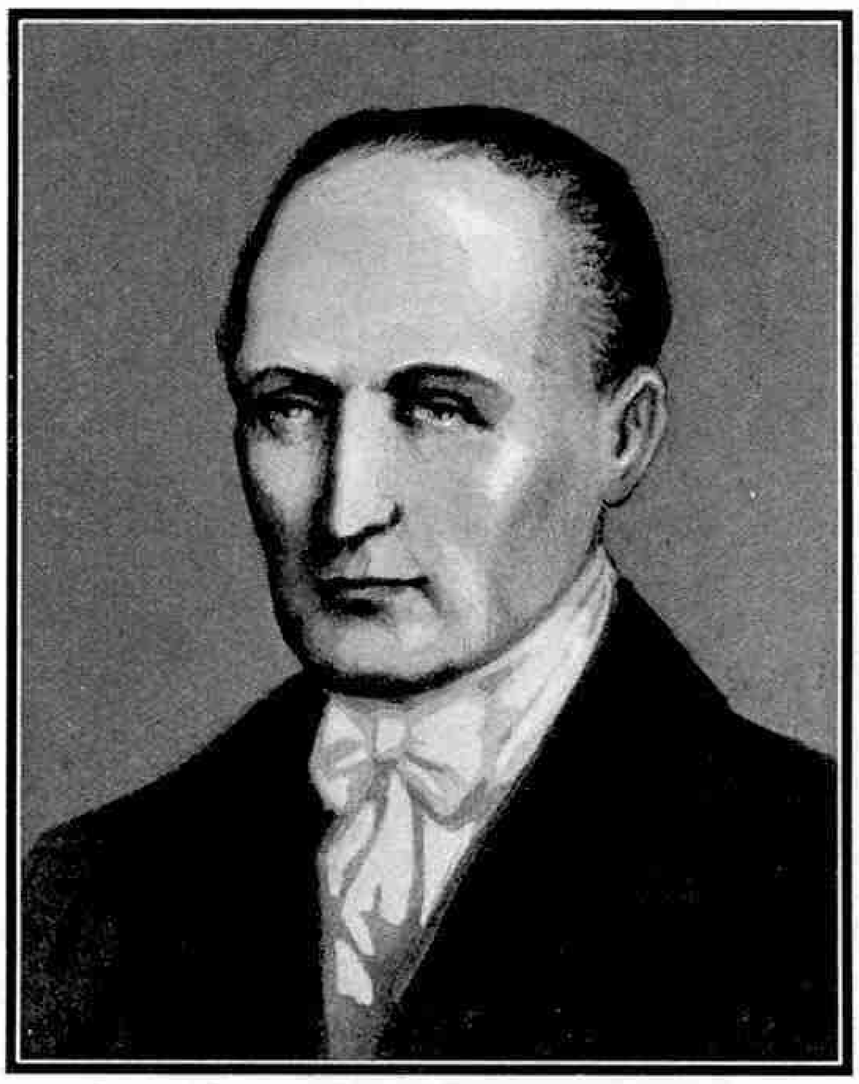
With the Editor

The Father of Photography

On the 3rd of this month occurs the centenary of the death of Joseph Nicèphore Niepce (1765-1833), a French scientist who is usually regarded as the inventor of photography. Niepce was a dreamy, imaginative boy, and did not seem to be attracted towards any definite occupation. In due course he served in the army, and was on active service in the French Revolutionary Wars. Ill-health compelled his retirement in 1794, and he was given an official appointment that he held for seven years, and then gave it up in order to devote himself to mechanical and chemical research.

About the year 1811 Niepce became interested in the art of lithography, or printing from stone, then recently invented. In his own experiments he substituted a plate of tin for a lithographic stone, and in 1813 the idea occurred to him of printing pictures on his plates by means of light. What he had in mind was a camera in which a lens formed an image on a plate coated with some material that would be changed by the action of the light falling upon it. Eventually he discovered that asphalt, after exposure to light, became less readily soluble in oil of lavender. He exposed in a camera for several hours a plate covered with a film of asphalt, and developed the resulting picture by placing the plate in a dish of the oil.

This process was very crude, and did not seem likely to be of much practical value. An exposure of from seven to eight hours was normally necessary, and even if the photographer was fortunate enough to be favoured with a specially bright day, this time could not be reduced to less than three hours. These times contrast sharply with those now required, for with fast modern plates or films, and a camera fitted with a wide aperture lens, good results can be obtained with exposures of as little as one thousandth of a second or even less.



Joseph Nicèphore Niepce, inventor of photography.

Much hard work had to be gone through before success was attained. Niepce persevered with great determination, however, trying all sorts of materials, and at last, with the help of L. J. M. Daguerre, a scene painter, he discovered a more rapid process that led to a great advance. In this process a polished silver plate was exposed to the vapour of iodine, a chemical element that was then obtained from seaweed. A coating of silver iodide was thus formed on the plate, and an image was produced on this coating by the action of light when the plate was exposed in a camera. The image was made permanent by washing the plate in salt water.

This new method had many drawbacks, for the pictures were very faint even after hours of exposure; and Niepce died before the practical difficulties were overcome. After his death Daguerre found that mercury vapour had a surprising effect on an exposed plate, transforming the faint or even invisible image into a clear picture. As the result of this discovery he was able to take portraits with exposures of only half-an-hour, and Daguerre's types, or daguerrotypes as they were called, became very popular.

Seeing the World

One of the most interesting and surprising developments of the depression in the shipping world is the introduction of short cruises for holidaymakers. Until quite recently the giant ocean liners were used almost exclusively on the shipping routes across the Atlantic Ocean, or to South Africa, India, the Far East and Australia; to-day active employment is being found for many of them on short pleasure excursions. The "*Mauretania*," for instance, makes voyages to Madeira; the "*Homeric*" visits the shores of Portugal, Spain and Morocco; and other famous vessels take their passengers southward to the Mediterranean, or northward to the fjords of Norway, the capitals of the countries round the Baltic Sea, and even to Spitzbergen in the Arctic Ocean.

This policy has proved remarkably popular, and thousands of people are seizing the opportunity afforded them of seeing other lands in a convenient and easy manner. Before short cruises became fashionable a visit to, say, Tangier on the North Coast of Africa, was a comparatively serious undertaking. Now a call there is merely an interesting incident in an attractive tour that enables those taking part in it to see a little of life in Northern Africa, a world that is so different from our own. Malta, the Riviera, Italy, and distant places in the Mediterranean or elsewhere can now be visited at comparatively small cost.

The popularity of short sea cruises seems to be due to a combination of many attractive features, prominent among which is the complete lack of trouble or worry. Everything is arranged beforehand, and all that passengers have to do is to enjoy themselves in the way that appeals to them most. Those who are old, or fat, or merely lazy, can spend the whole of the trip if they wish in lounging at their ease in the sunshine and fresh air. For those who are more energetic there is an endless succession of games and sports. Many of these were originally introduced with the object of lessening the tedium of long voyages, but they have been developed to a surprising extent. Practically every form of recreation that can be carried on satisfactorily within the limited space afforded by the deck of a liner is now available.

Another important advantage of the cruising holiday is that the voyage may be pleasantly broken by shore trips at various places, providing an opportunity of obtaining close-up glimpses of foreign life without any possibility of getting lost or into difficulties of any kind. Almost every holiday-cruiser takes with him a camera of some kind, and these shore trips provide an almost inexhaustible supply of interesting subjects.

Last year many people prophesied that the "cruising craze," as they called it, would not last, but this year the demand for accommodation is greater than ever. Short cruises, in fact, provide ideal holidays, and they have certainly come to stay.

A Bavarian Mountain Railway

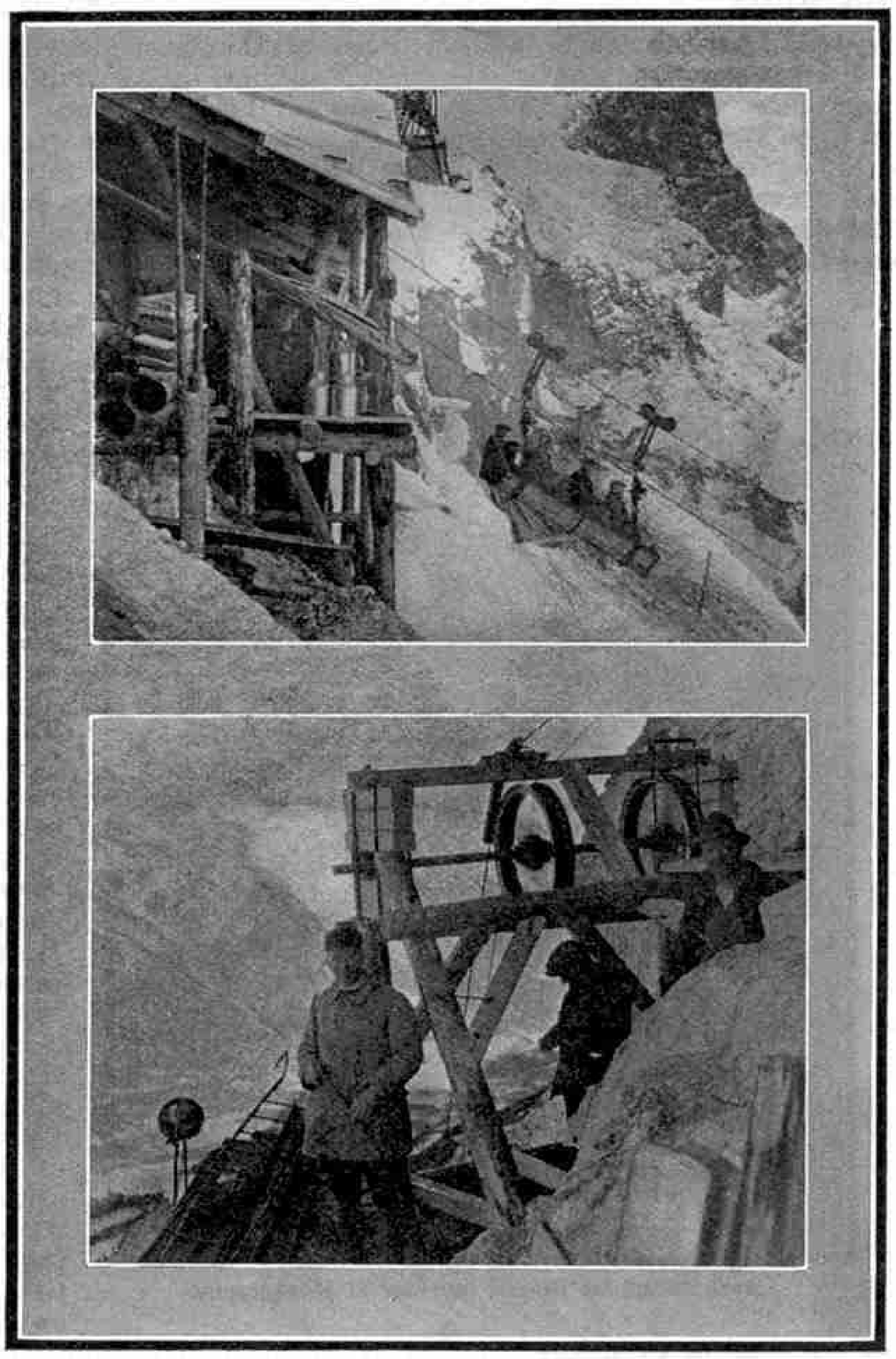
Built for Oberammergau Visitors

By Robert Peer

OBERAMMERGAU and the Passion Play are inseparably linked in the minds of most people, and yet comparatively few people know why there is this association. It will therefore not be out of place to refer to the reasons for this relationship before describing a recently-completed railway that was built specially to serve the great influx of visitors drawn to Oberammergau every 10 years, and to add to the pleasure of other tourists in the meantime.

Oberammergau dates back to mediæval days, and for centuries its inhabitants have devoted much of their energy and talent to the carving of crucifixes, rosaries, and images of saints, and to the making of wooden toys and similar articles. It was not until the world generally learned of the Passion Play periodically enacted in that Bavarian village that the place assumed a wider and deeper significance.

This ancient community lies on a route traced by Roman soldiers and tradesmen bound to and from the shores of the Mediterranean 1,000 or more years ago. It is situated about 45 miles to the south-west of Munich, and in that section of Germany known as Upper Bavaria. The village is set in the picturesque valley of the Ammer River, and nestles among the foothills of the Alps. The region is one of great scenic beauty, and it is not hard to understand how the simple-hearted people of Oberammergau in their comparative isolation have responded with a marked intensity of feeling to the spiritual appeal of life.



Two views of the cableways used in the course of constructing the Bavarian Zugspitze Railway.

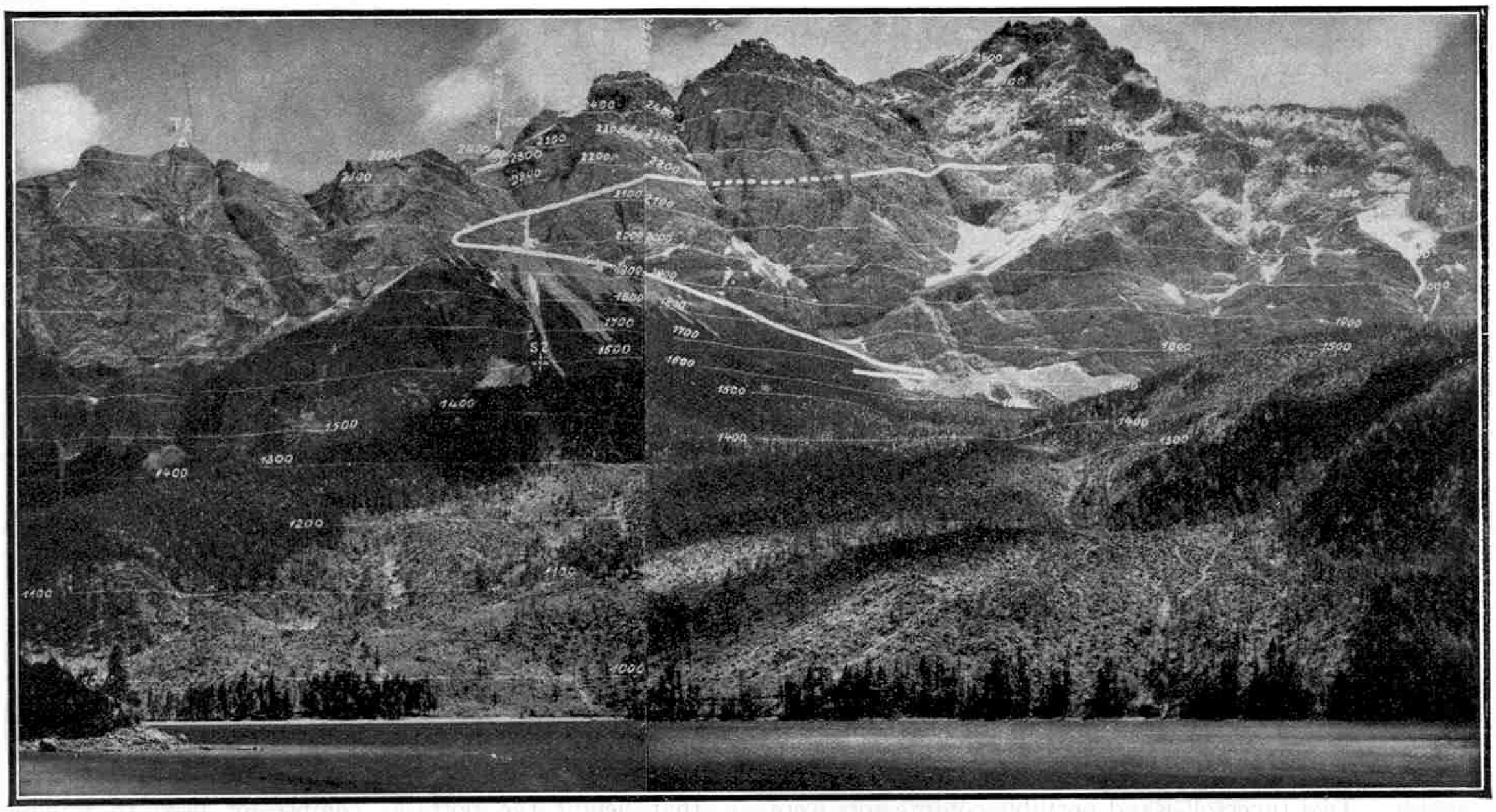
In 1632 Oberammergau, with other sections of Bavaria, was swept by the plague; and between the autumn of that year and July of the succeeding year no fewer than 84 persons succumbed to the dread disease. The community at that time numbered scarcely 600. Appalled by the ravages of the scourge, and fearing that it would not cease to take toll until all were stricken, the villagers pledged themselves to give a Passion Play every 10 years if the hand of death were stayed. After the making of that solemn vow, so tradition has it, no more of the inhabitants died of the plague.

The original form of the play is attributed to the monks of Ettal, who dwelt in a monastery situated a little higher up the valley. Undoubtedly the text was modified in the course of succeeding decades, and the form of the play was carefully revised by the Parish Priest of Oberammergau early in the 19th century. Music for the dramatisation was composed by the village schoolmaster, one Rochus Dedler, in 1814.

The first Passion Play was given in 1634, and since then the presentation at regular intervals has been deemed a sacred duty. For substantially three centuries the pledge has been kept that was made when the people of Oberammergau feared their extinction. For more than 200 years of that period the giving of the play entailed a heavy monetary loss, which was met without murmur by the community and the church.

As early as 1840 attendance at the Passion Play had become so large that the existing theatre, although capable of seating a vast number of people, was too small for the purpose. Emperors, kings and princes found themselves guests in the Bavarian village side by side with humbler folk, who had journeyed from all over the world to witness the unique spectacle. That situation led to the construction of an open air theatre that could accommodate a greater number. After the Great War the theatre was again rebuilt on a more elaborate scale, and it can now seat an audience of considerably more than 6,000. In 1900 there were more than 200,000 visitors to the Passion Play; in 1930 the combined audiences numbered more than 300,000, of whom 50,000 were from the United States.

In the prescribed years the Passion Play is given during May, June, July, August and September on every Sunday and holy day, with two exceptions, and also on every Wednesday from 1st July to the middle of September. Each performance begins at 8 a.m. and ends at 6 p.m., with an interval of two hours in the middle of the day. There are 55 principal characters, a choir of 45, and two soloists, and an orchestra of 50. With the supernumeraries representing soldiers, crowds, etc., the total stage personnel



The towering Zugspitze viewed from the shore of Lake Eibsee. The heavy white line and the dotted section indicate respectively the open and the tunnel divisions of the Bavarian Zugspitze Railway.

is something like 700. For some time now the Passion Play has made handsome returns upon the outlays, and after all expenses have been met the surplus is devoted to the good of the community.

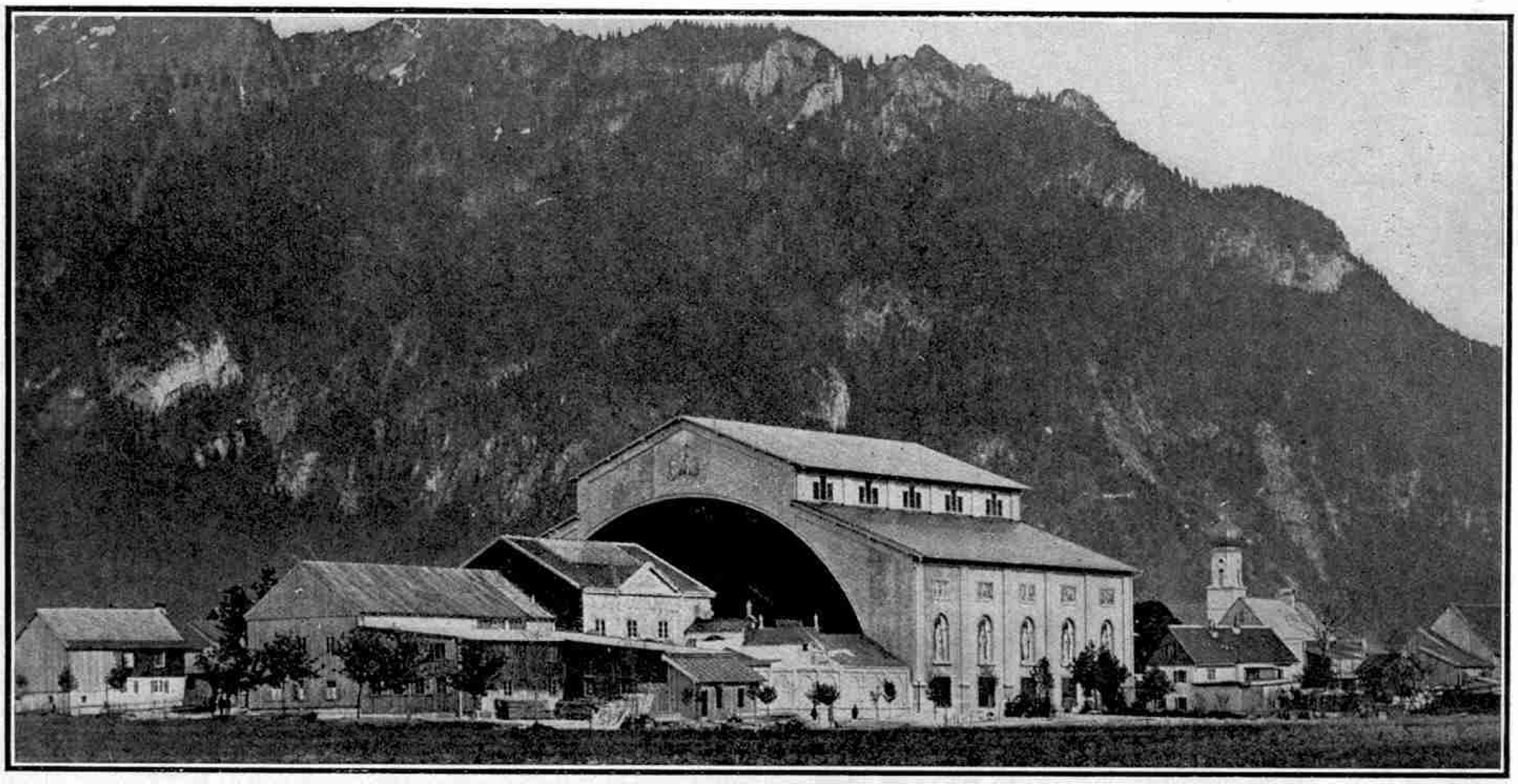
The principal parts are commonly hereditary in certain of the village families, and assignments for these parts are made with regard to the moral character of the actors and their dramatic ability. The inhabitants look upon the play as an act of religious devotion, and they strive reverently to portray the biblical characters they are called upon to represent. In this they are carrying out communal tradition.

The average stay in Oberammergau of the Passion Play visitor does not exceed parts of three days, and as the village is in the midst of a mountain region of great scenic charm, it is natural that a considerable proportion of these tourists should want to linger awhile in the neighbourhood to see some of the many points of interest in the countryside. One of these centres of attraction is Garmisch-Partenkirchen, the well-known Bavarian health resort. Beyond this place rise the towering crests of the Bavarian Alps, which are dominated by the highest mountain in Germany, the famous Zugspitze, with an altitude of 9,738 ft. The Zugspitze lies on the border between Austria and Germany, and just before the summer of 1930 a cog-wheel railway was constructed that links the mountain with Garmisch-Partenkirchen. This enabled visitors to the Passion Play to make, without difficulty, a trip in the glacial region of that mountain top.

The Bavarian Zugspitze railway must be distinguished from the Austrian one, which was constructed several years ago, and traces its route on the Austrian side of the mountain. The latter is really an electrically-operated aerial cableway, which is capable of transporting 19 persons per trip, and requires 20 minutes to reach the summit of the Zugspitze and to return to the starting point. The Bavarian line on the other hand is a regular mountain railway about 11 miles in length that can carry 150 people in each train. For 3.25 miles of the run it is a traction line, and from there onward it is a cogwheel railway, of which the first two miles have a maximum gradient of 11.85 per cent. and the remaining stretch an average gradient of 25 per cent. At a height of 4,950 ft. it enters a tunnel and arrives by a serpentine course at the uppermost station of Platt on the Plattach glacier. The total length of the tunnel is just short of three miles, and it is 11 ft. 4 in. in width and 15 ft. 5 in. in height.

A typical street scene in Oberammergau.

The construction of the tunnel was started simultaneously at four points, namely, the lower portal at an elevation of 4,950 ft., Adit No. 1 at 5,100 ft., Adit No. 3 at 6,600 ft., and Adit No. 4 at 7,200 ft. Adits Nos. 3 and 4 were situated in the middle of the northern vertical wall of the mountain mass. Special preparatory work was necessary to provide access to these adits, because of the steepness of the rocky walls and of the danger of avalanches of stone in summer and snow in



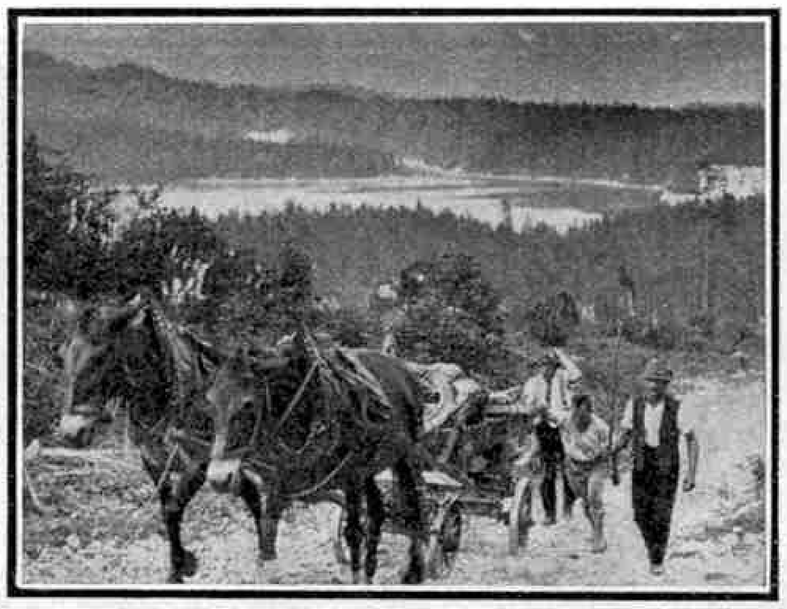
The theatre on the outskirts of Oberammergau where the Passion Play is performed.

winter. Two Ingersoll-Rand portable compressors were assembled at the foot of the palisade that rises almost sheer for 3,000 ft., and with the air power provided by these machines were operated pneumatic hammers that cut the clinging patches by which the otherwise inaccessible sites of these two adits could be reached. The compressors had previously been dismantled and their several parts packed on mule back up the mountainous approach to their working position at the foot of the rock wall.

Before tunnel driving could be started at Adits 3 and 4 the rock had to be cleared away at each place by drilling and blasting so that the tunnel men could have a foothold to do their work. This blasting had to be done with the utmost caution, and in this manner an operating base was provided at each of the adits for a cableway station, quarters for the workers, and a chamber in which to erect stationary compressors.

The tunnel was driven by first advancing a bottom heading to the full width of 11 ft. 4 in. and 9 ft. in height, after which enlargement to full profile followed at a distance of approximately 300 ft. to the rear of the bottom heading. Where the bottom heading was in soft rock it was driven with hand hammers; but when hard rock was encountered the driving was done with drifters mounted on vertical columns. The tunnel was advanced at an average rate of 16 ft. every 24 hours.

The last section of this system is, to be exact, not a railway but a cableway, and it extends from the Plattferner—the uppermost portal of the tunnel, which lies at an altitude of 8,000 ft.—to the topmost station, which is about 9,000 ft. above the sea. In preparing the anchorage for the upper end of the cableway and for the site of the hotel that now stands there, a good deal of drilling and blasting had to be done. Even at that height the portable compressor used to provide air for the rock drills gave no trouble, and greatly facilitated the rapid execution of the work. The hotel, which is situated at the summit of the Zugspitze, is typically modern, and is capable of accommodating 400 guests.



Portable compressors being conveyed in sections up a mountainside from the Eibsee.

The completion of the Bavarian Zugspitze railway brought one of the most noteworthy engineering jobs in Europe to a successful conclusion. The men in charge of the work were obliged to surmount great difficulties, and to guard continually against many dangers, owing to the exceptional heights and the steepness of the mountain sides. Rolling boulders and avalanches of stones were almost daily occurrences, and care had to be exercised at all times to protect the workers, machinery and equipment from the destructive onrush of these masses. In spite of the many obstacles and hazards this technically interesting railway was made ready for service within the short period of two years and, thanks to the foresight and experience of the officials in charge, accidents were relatively few.

For permission to reprint this article and for the illustrations we are indebted to the courtesy of the Editor of the "*Compressed Air Magazine.*"

* * * *

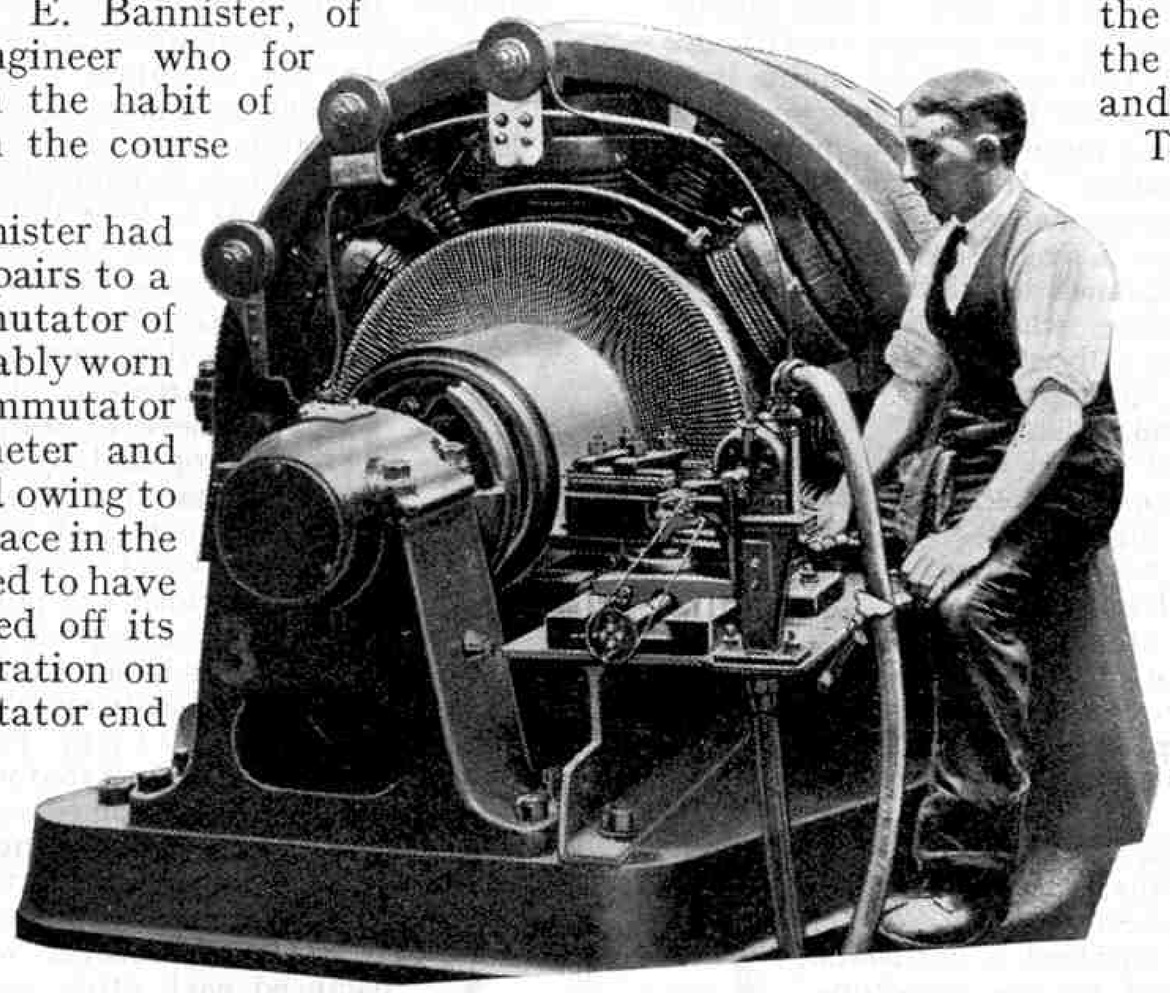
Bavaria is a little smaller than Scotland and has a population rather less than that of Scotland and Wales together. It is an agricultural country, producing large quantities of grain and hops. The capital is Munich, a beautiful city of some 680,000 inhabitants, on the River Isar. Another famous city is Nuremburg, the home of Hans Sachs, the great poet and playwright of the 16th century. Albrecht Dürer, the painter, also lived here.

Meccano Used in Real Engineering

Remarkable Applications of Standard Parts

MANY instances have been mentioned from time to time in the *"M.M."* of the successful use of Meccano in actual engineering jobs. This month we are able to publish details of some interesting mechanisms devised by Mr. E. Bannister, of Chudleigh, Devon, an engineer who for several years has been in the habit of utilising Meccano parts in the course of his work.

Some time ago Mr. Bannister had occasion to carry out repairs to a 250 kW dynamo, the commutator of which had become considerably worn with constant use. The commutator measured 15 in. in diameter and 14½ in. across the face, and owing to the wear that had taken place in the track of the brushes it needed to have approximately $\frac{3}{16}$ in. turned off its diameter. The upper illustration on this page shows the commutator end of the dynamo, and alongside it can be seen an ordinary lathe slide rest fitted up for the purpose of re-turning the commutator. The only slide rest available for the job was a heavy and cumbersome one that had a travel of 17 in. on the slide, and weighed 2 cwt.



This illustration shows the commutator end of a 250 kW dynamo, with a lathe slide rest driven by Meccano Sprocket Chain and gearing rigged up for the purpose of re-turning the commutator.

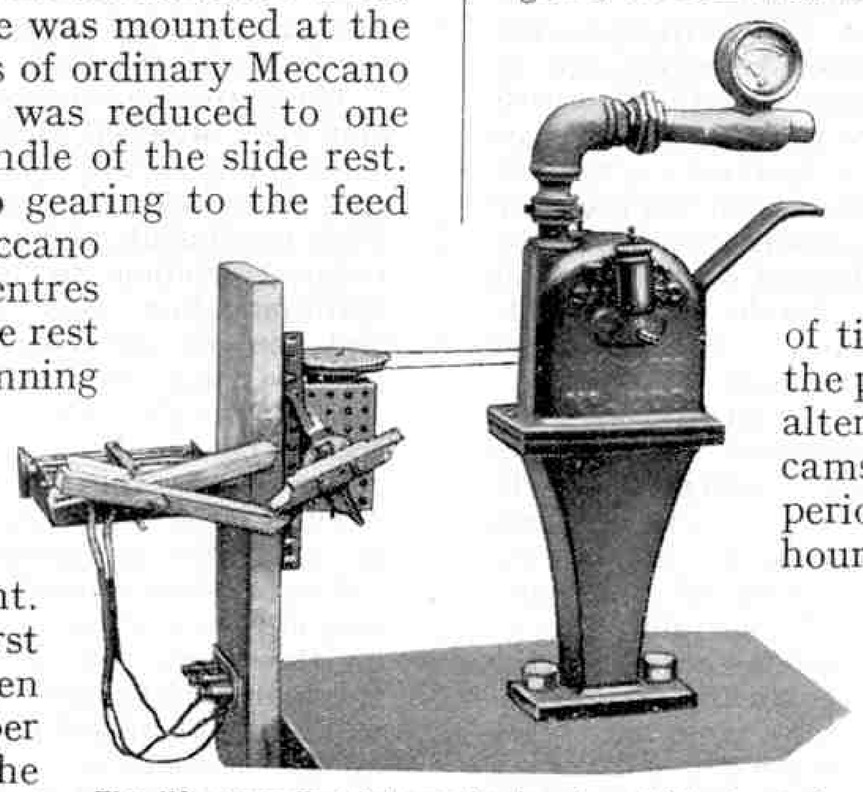
In order to avoid the long and tiring task of feeding the cutting tool by hand, Mr. Bannister set to work to devise a mechanical feeding arrangement, and it was then that he decided to call in the aid of Meccano. First of all a "Thirlmere" water turbine was mounted at the side of the slide rest, and by means of ordinary Meccano gearing the speed of the turbine was reduced to one suitable for operating the feed spindle of the slide rest. The final drive from the Meccano gearing to the feed spindle was by means of Meccano Sprocket Chain, working at 8½ in. centres to a large Sprocket fixed to the slide rest feed spindle. With the turbine running at a convenient speed, a tool feed of $\frac{5}{32}$ in. per minute was obtained. The commutator was driven at a constant speed of 50 r.p.m. by the engine of the generating plant.

Three roughing cuts were first taken, and the gearing was then altered to give a feed of $\frac{1}{16}$ in. per minute for the finishing cut. The work was completed after 10 hours of actual turning, and during the whole of this time the Sprocket Chain was under a tension of 15 lb. With the exception of adjustments to take up a small amount of stretch, the original piece of Chain completed the job without failure, the elongation of the Chain after use being found to be just under five per cent.

Shortly afterwards Mr. Bannister wished to test out a special lift controller. For the purpose of this test it was necessary to reproduce, automatically and alternately, the function of operating what on the actual lift would be the "up" and "down" push-button switches.

The mechanism that he ultimately used for the test is shown in the lower illustration. It consists of a system of mercury switches arranged so that they could be tripped alternately and at given intervals. The controller comprised two main "up" and "down" contactor switches and a number of what are known as dashpot-controlled switches; and was connected through a 220-volt D.C. supply to the lift-operating motor. The motor was given a load by driving direct a generator short-circuited through a resistance.

The power for driving the test mechanism was obtained from the "Thirlmere" water turbine already mentioned. The primary reduction from the turbine consisted of the maker's worm reduction gear of ratio 150 : 1, and the final drive was in the form of a round gut belt. By means of a Meccano Pulley the belt drove a 50 : 1 Meccano Worm reduction gear, which was housed in a box built up from Meccano Plates as shown in the illustration.



The lift controller test mechanism in which standard Meccano parts were used for working switch tripping gear, as described on this page.

On the spindle of the final drive were fitted two cams that tripped the arms on which the mercury switches were mounted. Thus for one revolution of the cams each switch was operated twice within a certain period of time, which could be varied by moving the position of the fulcrum of the arms, so altering their position in relation to the cams. The test was carried out over a period of 14 days, with a duration of eight hours' continuous running per day; and except for occasional lubrication the mechanism required no attention whatever.

On another occasion Mr. Bannister required a mechanism for the purpose of illuminating alternately, and at fixed time intervals, three gas lamps, which were to be used in a showroom demonstration of street lighting. Two of the lamps were to be illuminated with the third and largest lamp off, and then this lamp was to be lighted while the two

*(Continued on page 552)

The Gyroscope and Mono-Rail Transport

A Wonderful Mechanical Balancer

IN 1859 Charles Blondin, a Frenchman, astounded the world by walking several times across a rope stretched between the banks of the Niagara River immediately below the Falls. He maintained his balance during his perilous journeys by means of a long pole, and he was so much at home on the frail bridge that he was able to cross with a man on his back. These famous feats of Blondin have been surpassed by a mechanical contrivance that requires no such aid as a long pole in order to enable it to maintain its balance. This contrivance is the gyroscope, and it is capable of balancing itself in even more precarious positions than the most skilful tightrope walker. It has the further advantage that it can be applied to practical use in balancing trains and other vehicles running on a single line, and in steadying vessels at sea and aeroplanes in flight.

The central feature of a gyroscope, whatever the purpose for which it is designed, is a flywheel with a heavy rim that can be rotated at high speed. The axis of a spinning top of this kind endeavours to retain its direction in space, and efforts to alter this direction are strongly opposed so long as the flywheel is spinning at high speed. This may be shown with the aid of a toy gyroscope similar to that shown in Fig. 1, which may be bought for a small sum at any toy shop or store. The wheel is spun by sharply pulling a piece of string wrapped tightly round its axle, and the gyroscope then easily balances itself, remaining upright until the speed falls too low If the spinning toy is held in the hand and turned over, its efforts to resist the change of direction of its axis are distinctly felt.

The same effect may be shown in an even more striking manner by supporting one end of the axis of the spinning flywheel in a loop of string, as shown in Fig. 2. The initial direction of the axis of the flywheel is horizontal, and so long as the rotation is kept up the gyroscope remains in the position illustrated.

The ability of a gyroscope to maintain its position enables it to perform many remarkable feats. For instance, it can be balanced on a piece of tightly stretched string, as shown in Fig. 3. If it is spun on a smooth narrow surface, such as the edge of a flat ruler or the rim of a tumbler, and this surface is suddenly tilted, the gyroscope does not topple over, but retains its upright position in a manner that suggests ability to defy gravitation.

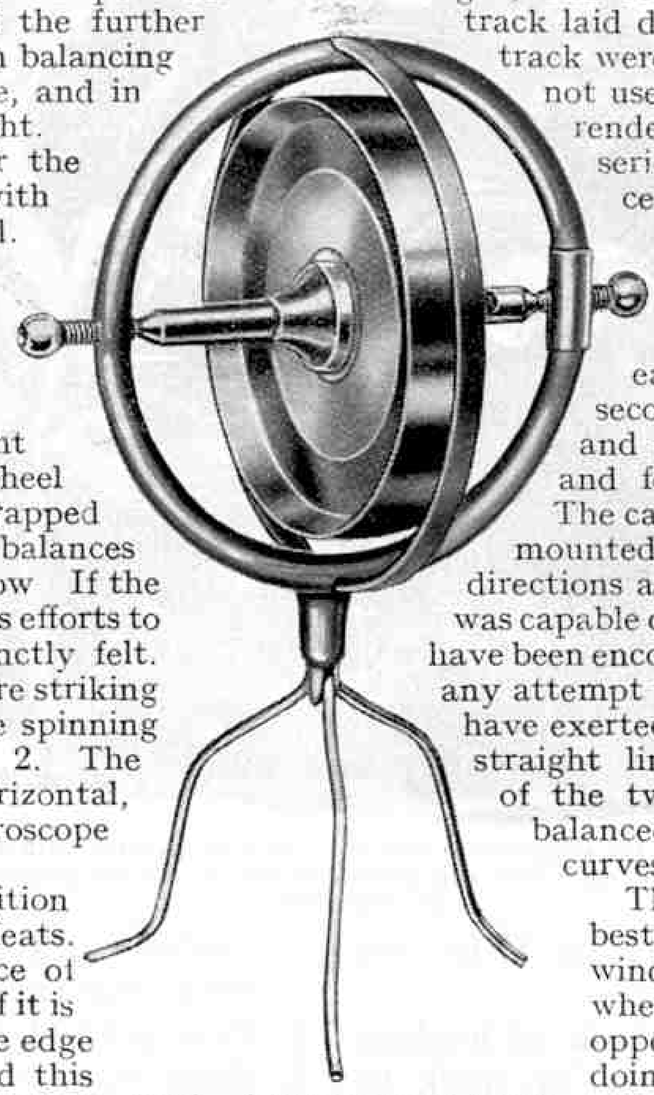


Fig. 1. A toy gyroscope, loosely pivoted on a stand, maintaining an upright position while spinning.

The remarkable balancing power of the gyroscope soon attracted the attention of inventors, some of whom saw in it a means of balancing vehicles on wheels placed in line with each other instead of at the sides. There are many advantages involved in schemes of this kind. For instance, a railway train balanced by means of a gyroscope would require only a single rail. Thus the cost of track construction would be greatly reduced, and lines could be planned on shorter and more convenient routes than are practicable when a wide level surface has to be cleared for sets of double rails.

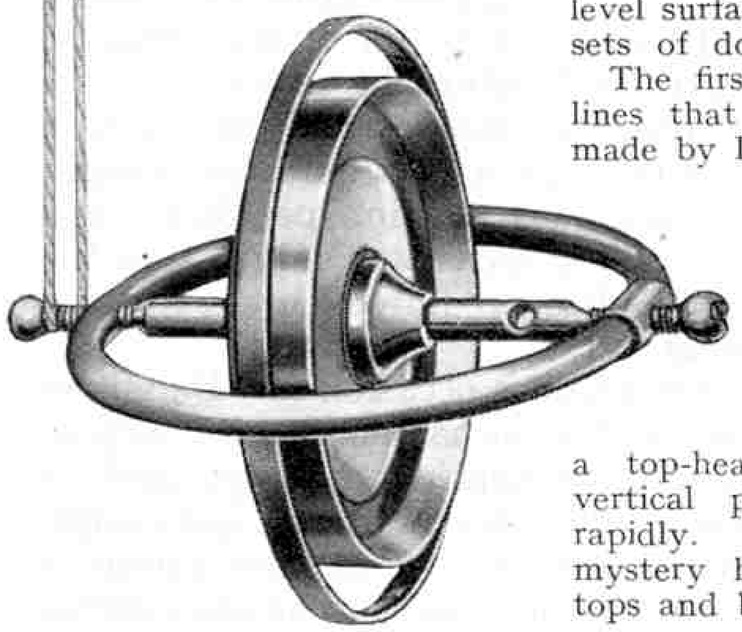


Fig. 2. The gyroscope holding itself horizontally from a loop of string.

The first experiments on these lines that promised success were made by Louis Brennan, a watchmaker who became famous as the inventor of a torpedo. He had always been interested in the balancing power of tops, and had often wondered why a top-heavy top maintained a vertical position when spinning rapidly. In order to solve the mystery he bought all kinds of tops and built others himself, and after many years of experiment with them he evolved his scheme for a mono-rail car working on the gyroscopic principle. Brennan demonstrated his invention before the Royal Society in 1907, using for the purpose a small model. The model travelled along a single wire stretched about 6 ft. above the floor, and in spite of being repeatedly and suddenly stopped, while the wire was swung violently, it maintained perfect balance.

The demonstration was successful, and the War Office became interested in the invention. Brennan was granted a subsidy that enabled him to construct a full-size gyroscope car, 40 ft. in length, and tests were carried out with this car on a single track laid down at Gillingham, Kent. The sleepers of this track were 3½ ft. long and laid 2 ft. apart, and ballast was not used, as the automatic balancing power of the car rendered this unnecessary. The car had a single series of wheels arranged longitudinally down its centre line, and the wheels were flanged on each side instead of on one side only as with the wheels of ordinary rolling stock. The car was propelled by a 80-h.p. petrol engine driving a dynamo that supplied current to two motors, each attached to one wheel of the bogie. A second petrol engine of 20 h.p. drove another dynamo and provided the power for rotating the gyroscopes and for working an air compressor.

The car was balanced on its single rail by two gyroscopes mounted vertically side by side, and revolving in opposite directions at 3,000 r.p.m. For a straight track one gyroscope was capable of doing all that was necessary, but difficulty would have been encountered on curves, because the gyroscope, resisting any attempt to make it change its direction of rotation, would have exerted a strong effort to keep the car travelling in a straight line. This difficulty was overcome by the use of the two gyroscopes which, with their opposite spin balanced each other and left the car free to negotiate curves.

The balancing power of the gyroscopes was shown best when the car was running with a strong side wind blowing against it, causing the gyroscope wheels to tilt sideways. The axle ends on the opposite side of the car then rose slightly, and in so doing pressed with considerable force against guide plates that transmitted the pressure to the car, and supplemented it by bringing into operation the air compressor. The combined effect of the air compressor and the gyroscope wheels was sufficient to compel the car to resist the force of the wind.

The gyroscope wheels were of white metal, and each weighed three-quarters of a ton. They were enclosed in vacuum cases so that there was no air resistance to hinder their movement, and special bearings reduced friction to a minimum. Self-lubrication was employed, and the oil, after serving its purpose, was automatically forced through a series of cooling coils and returned to the oil reservoir.

During the experimental runs, the gyroscopes did not always succeed in keeping the car balanced on the single rail, but eventually Brennan prevented them from oscillating by introducing a complex system of compressors and a liquid pressure valve. The Government did not grant him any further subsidy and eventually lack of funds compelled him to abandon his experiments. He

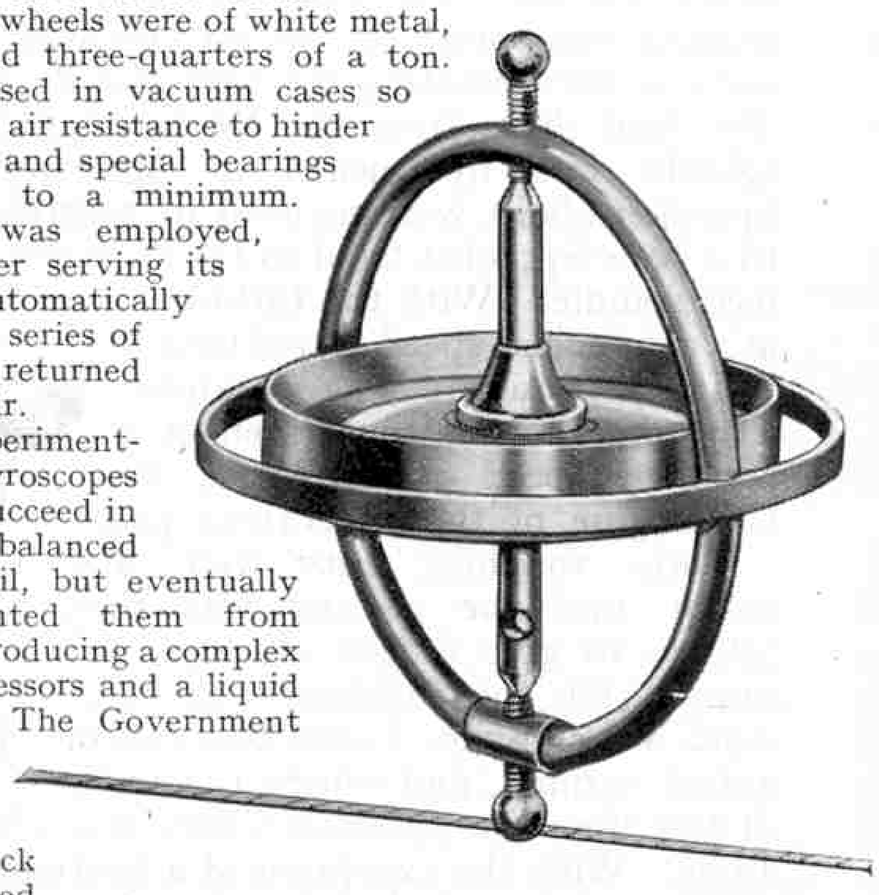
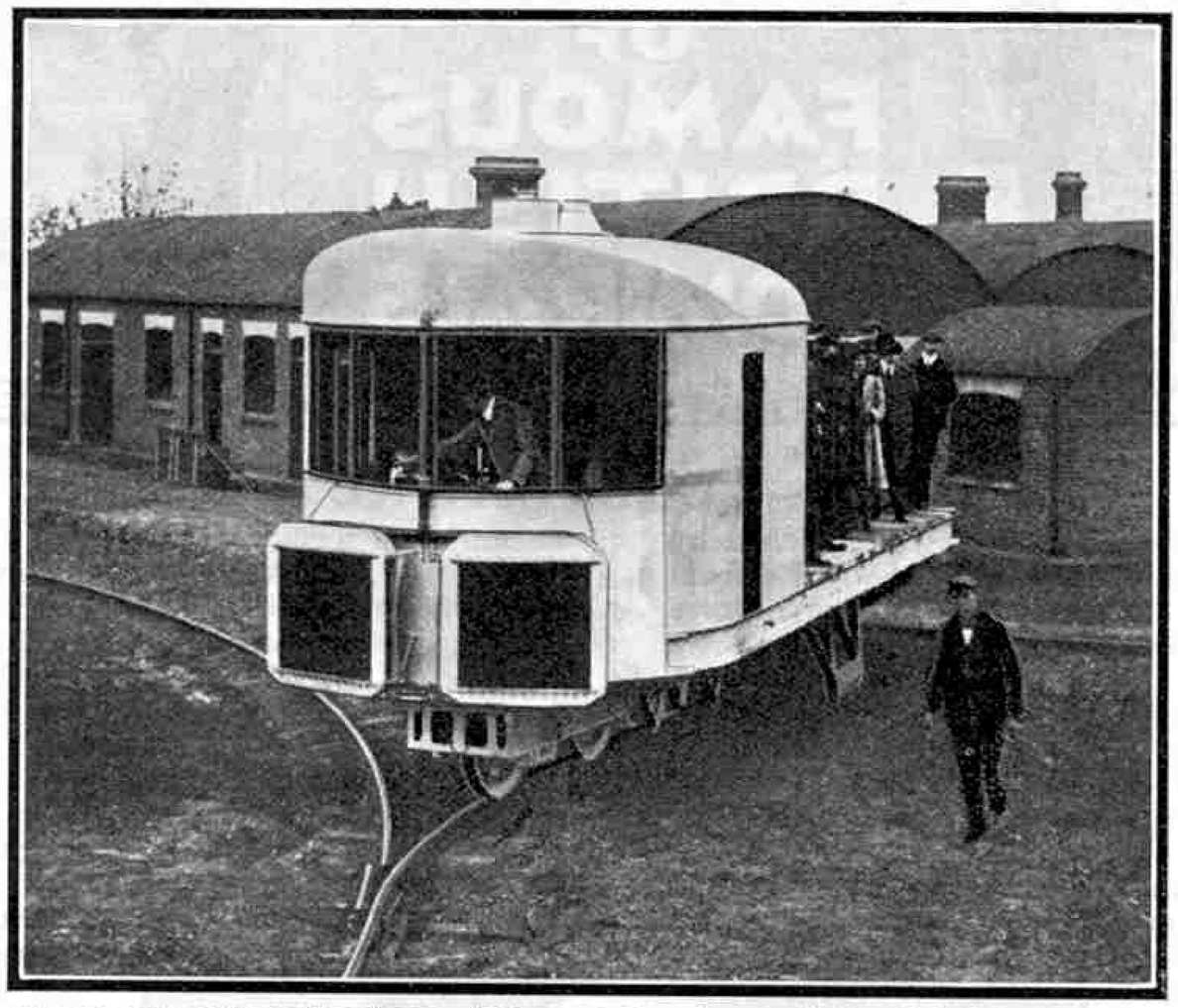


Fig. 3. A "mechanical Blondin." The gyroscope balancing itself on a stretched string.

had proved the practicability of a gyroscopic railway, however, and there is little doubt that mono-railways operated on his principle will play an important part in the transport of the future. The cars, travelling at speeds of 130 m.p.h. or more, may not even be on a single rail, but may travel along a steel rope supported by towers and spanning valleys and rivers in the manner indicated on our cover this month.

Brennan sold his patents to Dr. Elmer A. Sperry, an American who was interested in the possibilities of utilising the gyroscope as an aid to the navigation of ships and as a means of steadying ships at sea. The first fruit of Dr. Sperry's research was his invention of the gyro-compass, and this was followed by many other devices of similar character. The problem of checking the rolling of ships was solved by the invention of the Sperry gyro-stabiliser. The first appliances of this kind were installed in pleasure yachts, and they proved very successful in restricting rolling within reasonable limits. Gyro-stabilisers are now being installed in much larger ships, and recent vessels so equipped include the "*Conte di Savoia*," a 45,000-ton Italian liner, and the "*Hosho*," a Japanese aircraft carrier of 10,000 tons.



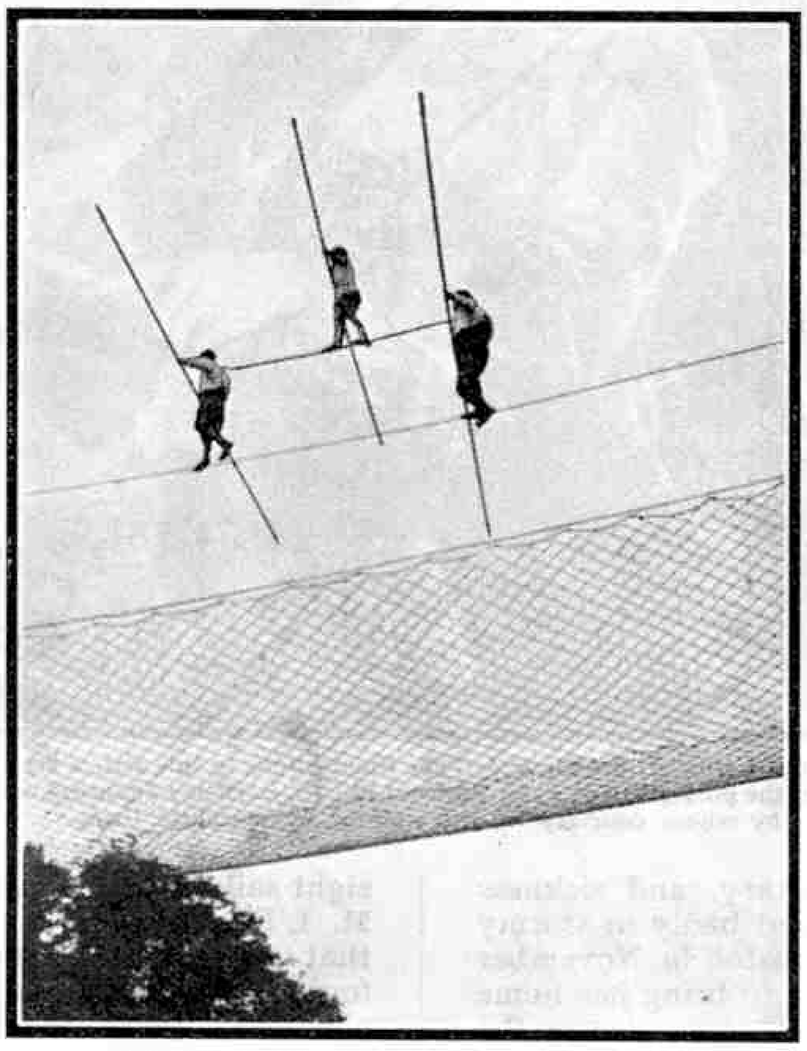
The Brennan gyroscopic rail car. This was balanced on a single rail by two gyroscopes mounted side by side and revolving in opposite directions.

The action of the gyro-stabiliser used in a ship depends upon an even more remarkable peculiarity than its tendency to maintain its position and the direction of its axis in space. If the axis of a gyroscope with its flywheel spinning horizontally is tilted, the movement is strenuously resisted, and at the same time the gyroscope twists sideways apparently in an attempt to dodge away from the tilting force. For instance, if we suppose the flywheel of the gyroscope shown in Fig. 3 to be rotating in the opposite direction to the hands of a watch when seen from above, and the upper end of its axis is pushed away, that is into the plane of the paper, the gyroscope as a whole will bend to the left. Similarly, if the upper end of the axis is pulled forward, the gyroscope will move in the opposite direction.

A ship's gyro-stabiliser has a horizontal rotor or flywheel and is enclosed in a casing resting on bearings in solid pillars on each side of it. Any movements it makes sideways therefore are transmitted to the vessel in which it is fitted. Suppose that the gyroscope shown in Fig. 3 were mounted in a ship in this manner, and looked at from a position aft. If the upper end of the axis of the rotor were tilted forward, the casing would attempt to turn in such a manner as to press downward on the pillar on the port side. Thus it would tend to roll the ship to port, and its action would help to stop any roll to starboard brought about by wave action.

It will be seen that in order to counteract a roll to starboard the upper end of the axis of the rotor must be tilted forward, while a roll to port is stopped by tilting it aft. In the Sperry gyro-stabiliser these movements are brought about in a very ingenious manner, the beginning of a roll actually setting the giant top in action. The chief agent in this is a small and very sensitive gyroscope consisting of a rotor mounted in much the same manner as that of the stabiliser itself, but placed with its axis athwartship. When the roll commences this axis is tilted, and the gyroscope then turns in the peculiar manner already described. This has the effect of closing a switch that supplies current to a direct current motor geared to a toothed ring surrounding the casing of the gyro-stabiliser. The motor immediately comes into action and tilts the axis of the rotor of the stabiliser in the required direction. A roll in the opposite direction closes other contacts that cause the motor to rotate in the opposite direction, and thus to tilt the stabiliser in the opposite sense.

The small gyroscope thus acts as a trigger, bringing the stabiliser into action when required. The stabiliser itself has a range of movement of 60 degrees forward and 60 degrees backward, and the whole range of 120 degrees can be covered in from eight to 18 seconds. The anti-rolling force comes into play immediately the forward or aft movement of the gyro-stabiliser begins, and as the control gyroscope acts less than a quarter of a second after the sideways movement commences, a roll is checked long before it becomes really noticeable. In trials carried out in rough weather with a vessel of 1,200 tons, the greatest roll experienced was one of only 3 degrees, but heavy rolling commenced immediately the stabiliser was put out of action, the vessel swinging violently from side to side until it heeled over at an angle of 37 degrees, and in one instance of as much as 44 degrees. The steadiness of a stabilised vessel also enables her to be steered more accurately and easily, and less engine power is wasted; while a higher average speed can be maintained in rough weather.



Human balancing with the aid of long poles. Photograph by A. B. Chatfield, Crewe.

The gyroscope forms the basis also of various devices that have been designed to steady aircraft in flight, and to enable them to maintain a pre-set course without human aid. One such device, known as the Smith Automatic Control, achieves this by means of mechanism that controls the rudder and elevator of the machine. The required course is defined by means of the axis of a gyroscope. When a machine deviates from this course, the frame in which the gyroscope is mounted turns with it. The axis of the spinning flywheel continues to point in the same direction, however, and thus moves relative to its frame. This movement is employed to operate two piston valves, the pistons and cylinders of which are connected to the gyroscope and its frame respectively. When the course or trim of the aircraft is altered, the relative movement between the gyroscope and its frame operates the sensitive valves, and as their pistons move they actuate the aircraft controls through servo, or auxiliary, motors. One of the piston valves controls the rudder and the other alters the position of the elevator, in each case acting in such a manner that the machine is almost instantly restored to its true course. The flywheel of the gyroscope is driven by compressed air supplied by a small windmill-driven air compressor.

The Smith Automatic Control maintains the direction and altitude of the machine in any atmospheric conditions, and is so sensitive and powerful that it detects and corrects deviation far more quickly than a pilot can do, and more quickly than the usual flying instruments can show the deviation. It applies control movement proportionate to the change of direction and altitude, with the result that the rudder and elevator movement is gradually reduced as the aircraft returns to its correct attitude. The pilot, having no piloting to do for long periods, can devote a calmer mind to the problems of navigation, or observation; and in large aircraft he may safely leave his seat and carry out any duties that may require his attention. Navigation in cloud or clear air is not only more precise but far safer with the Control than with a human pilot, and the range of the aircraft is also increased, due to the precision of flying.

VII.—LORD HAWKE

BRITISH naval history during the 18th century is enriched by the outstanding achievements of many men who rose from the lowest ranks to become famous Admirals. We have already dealt with Anson and Boscawen, and this month we come to Lord Hawke.

Edward Hawke was born in London in 1705, and was the son of a barrister. His father died in 1718, and the boy was then placed under the guardianship of his uncle, Lieut.-Col. Martin Bladen, who had served with Marlborough in France. He was educated for a naval career, and on 20th February, 1720, he joined the ship "*Sea-horse*" as a volunteer. The story goes that when Hawke was leaving home his mother said: "Adieu, Ned, I shortly expect to see you a captain." He replied: "A captain, madam? I hope you will soon see me an Admiral." Hawke served aboard the "*Sea-horse*" for five years, and subsequently for short periods in many other ships. By successive promotions he attained a responsible rank, and in 1733 he was given command of the sloop "*Wolf*."

Further promotion soon came to him, and in March of the next year he was raised to the rank of Captain and placed in command of the "*Flamborough*." During times of peace there was very little for the Navy to do, and when this ship was paid off in September 1735 he retired on half pay, and remained at home until the outbreak of war with Spain in 1739. He then re-entered active service, obtained command of the "*Lark*," of 40 guns, and was sent to cruise among the Leeward Islands, with Barbadoes as his base, escorting fleets of merchant vessels. Later he returned home and was transferred to the command of a larger ship, the frigate "*Portland*," of 50 guns. In this ship he continued his work among the Leeward Islands, but never encountered any Spanish ships. The voyage was a troubled one, as the "*Portland*" was old and insanitary, and sickness developed among the crew. The ship also fared badly in stormy weather, and during one very severe gale off Boston in November 1741 she lost her masts. Hawke then decided to bring her home before she broke up beneath him, and after a slow voyage the "*Portland*" eventually reached this country again.

Hawke's uncle was influential in obtaining for him another command, and soon he was appointed to the "*Berwick*," a new 70-gun ship of the line that was one of several ordered to reinforce the Mediterranean fleet, then commanded by Admiral Mathews. The war with Spain had developed into a six-Power conflict, with France and Prussia allied to Spain, and Holland and Austria helping Britain. Mathews' ships were on guard at Toulon to prevent the enemy fleet in harbour there from being joined by reinforcements from Brest, and the arrival of the "*Berwick*" and other ships brought Mathews' fleet up to a total of 28 ships. On 11th February 1744 an allied French and Spanish fleet of 27 sail of the line came out of the harbour, and a battle was soon in progress. The English made a poor show, as their ships were so encumbered with barnacles that they were slow in manœuvring. As a result the rear half of the line failed to close with the enemy.

Hawke observed that the "*Poder*," one of the enemy ships, was successfully attacking the English vessels "*Somerset*" and "*Princessa*," and disregarding orders he left the line and headed for the enemy. He soon silenced the guns of one of the ships, the "*Neptune*," and then came to close quarters with the "*Poder*," and by concentrated heavy firing compelled her to surrender after only 20 minutes' fighting. Her guns were put out of action, her masts were down, and 200 of her crew were killed or wounded by Hawke's terrific onslaught. The hauling down of the "*Poder's*" flag was observed by several of the English ships, and these raced forward, their captains eager to obtain the sword of the defeated commander, but he would surrender it only to Hawke. The rest of the enemy fleet escaped, and although Hawke placed a prize crew aboard the "*Poder*," the enemy succeeded in recapturing her when the English fleet retired. Hawke's conspicuous bravery in this fight earned him the admiration of the King, George II, who called him "my Captain."

Portrait of Admiral Lord Hawke. The illustrations to this article are from prints in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, by whose courtesy we are enabled to reproduce them.

The next naval engagement in which Hawke figured occurred shortly after his promotion to Rear-Admiral of the White on 15th July, 1747. He was made second in command to Sir Peter Warren, Commander-in-Chief of the Western Squadron, and this fleet of 14 ships of the line sailed to the Bay of Biscay to look out for French squadrons and convoys between Ushant and Finisterre. Warren became ill soon after the voyage began, and Hawke was instructed by Lord Anson, then Vice-Admiral of the fleet, to take command in the "*Devonshire*." On the morning of 14th October, 1747, the "*Edinburgh*" sighted an enemy fleet that on approach proved to be a French squadron escorting 250 merchant ships. The squadron consisted of eight sail of the line and one 50-gun ship, and was commanded by M. L'Etenduere. The French commander was quick to observe that in armed vessels he was greatly outnumbered, and he therefore formed his squadron into line-of-battle array and waited to windward, while the convoy made off with the utmost speed. Hawke saw the fast diminishing sails of the convoy, and believing that the ships were heading for Martinique he sent a fast sloop to notify the Commander-in-Chief in the West Indies of their approach. As a result of this prompt action the merchant ships had a warm reception there and many of them were captured.

The battle between the English and French squadrons was severe. Hawke succeeded in getting to close quarters with the French 50-gun ship, and five minutes of heavy firing compelled her to surrender. In the meantime the "*Edinburgh*" had lost her foretopmast and the "*Eagle*" also was seriously damaged, and without waiting to board the French ship Hawke rushed to their aid. By the time the "*Devonshire*" reached these ships the "*Eagle*" had become almost unmanageable, and as she was listing badly Hawke was obliged to keep away from her. Later he

closed with the "*Terrible*," a French ship of 74 guns, and after a long struggle forced her to surrender. Darkness was now coming on, but the battle continued far into the night. Six of the enemy squadron were captured, three of them by the "*Devonshire*," and a few of the convoy were overtaken and captured. The other three ships of the French squadron succeeded in getting away during the night. Only one of the ships captured by Hawke was in a fit condition for the voyage to England, and he was obliged to repair the others before he could return home. The fleet and the prize ships arrived at Portsmouth on 31st October, and shortly afterwards Hawke was made a Knight of the Bath as a reward for his victory.

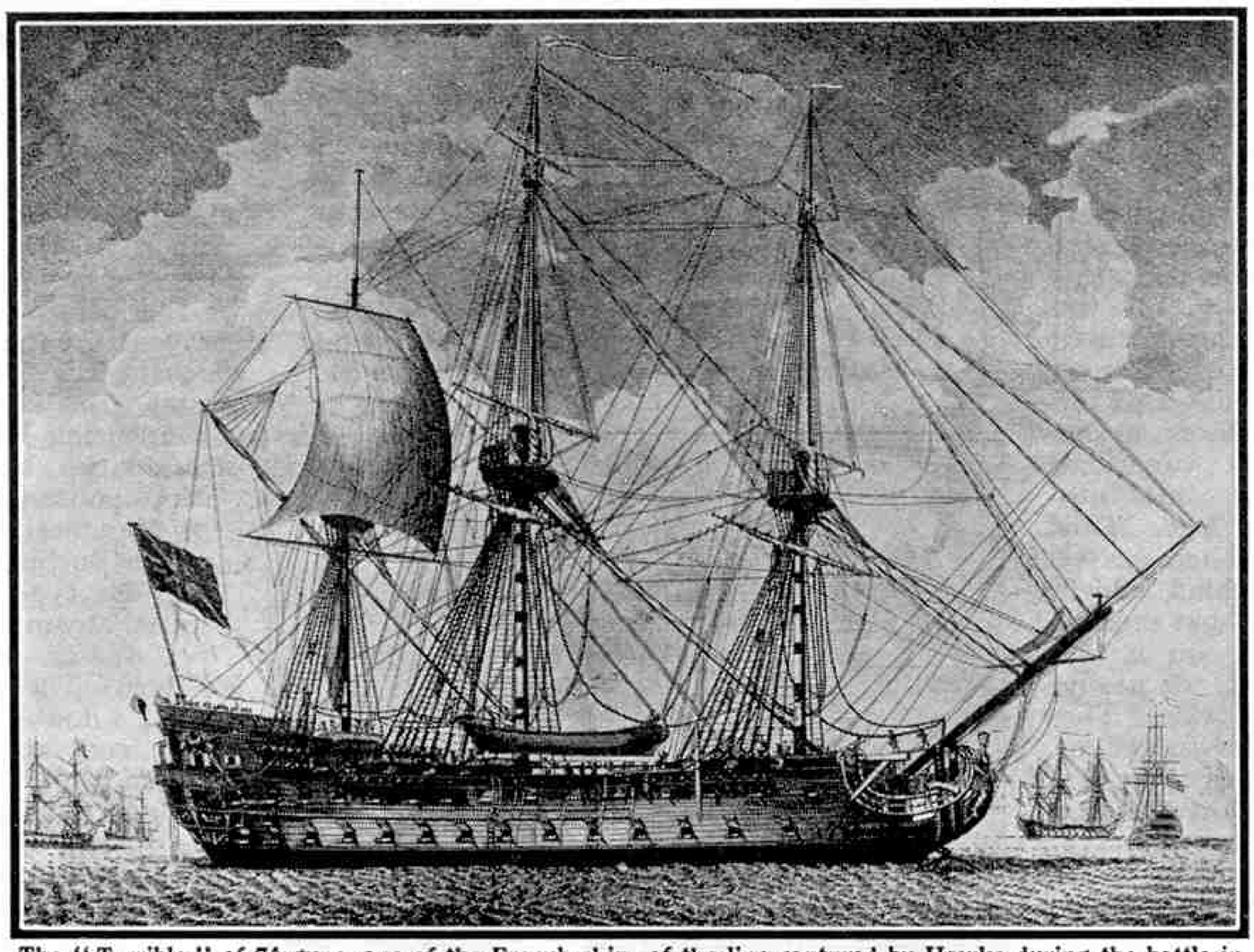
In December 1747 Hawke was elected Member of Parliament for Bristol, but very soon afterwards he was at sea again, being appointed in January 1748 to command a squadron ordered to cruise in the English Channel. During this cruise two of his ships encountered and captured a French line-of-battle ship that had been dismasted during a gale. The signing of the Treaty of Aix-la-Chapelle ended hostilities, and the squadron returned to Spithead in July 1748 and was paid off. During the next seven years Hawke was chiefly engaged on various dockyard commissions, and with his duties as a Member of Parliament.

Relations between this country and France again became strained, and in 1755 Hawke was given command of the Channel fleet of 18 ships, and ordered to cruise along the coast of France, seize any French ships he met, and if possible intercept a French squadron that was to convey reinforcements to Canada, where fighting between English and French forces was in progress. Hawke appears to have missed the squadron, but in a short time he had captured 300 French trading vessels. His activities naturally hastened reprisals, and shortly afterwards war was declared. In September 1755 Hawke was relieved by Admiral Byng, presumably to free him for some more urgent commission, but before long he was back in his old place, as Byng was placed in command of the Mediterranean fleet and ordered to protect Minorca. When news of his subsequent retreat reached England, however, Hawke was at once despatched to replace him and to send him home for trial. He arrived too late to save Minorca from being taken by the French, but he remained in the Mediterranean for five or six months and by his presence largely restored the confidence in Britain's naval power that had been lost by Byng's failure.

Early in 1757 Hawke was given command of a secret expedition formed to carry out an attack on the ships and docks at Rochefort, an important fortified French port near the mouth of the River Charente, which flows into the Bay of Biscay. The expedition consisted of a squadron of 16 ships, and a convoy of 55 transports carrying about 10,000 soldiers commanded by Sir John Mordaunt. The naval and army officers included several men who were destined to become as famous as those under whom they were serving, among them being Rodney and Howe on the naval side, and James Wolfe, Mordaunt's chief-of-staff, on the army side. The Bay of Biscay was reached without any unusual incident, and on 20th September the numerous ships anchored off the French coast. Bad weather delayed the attack for three days, but on 24th September Hawke captured the Isle of Aix, one of the chief defences of the city. Shallow water prevented the squadron from drawing close to the mainland to cover the landing of the troops, and after much debate Mordaunt decided not to carry out the attack, and the expedition returned home.

Naturally it received a cold reception, and at first Mordaunt and Hawke were in disfavour with their superiors for failing to carry out orders, but eventually Hawke was cleared of blame. He determined to make another attempt to destroy the fort, and he sailed in March 1758 with a fleet of seven sail of the line and three frigates His sudden reappearance in the Bay of Biscay caused the French ships to retire hastily up the River Charente, and this hurried move, made without time to take into account the varying depth of the river, caused many of them to run aground. Hawke's ships were unable to follow them, and he returned home, having succeeded only in giving the enemy a bad fright and in scattering their ships.

In May of the same year he was ordered to provide Howe with a small squadron so that another attempt on Rochefort could be made. He believed this change of command to mean that in view of his unsuccessful attempt on the fort the Admiralty regarded him as inefficient, and with a protest to them he struck his flag and resigned his command. His services were too valuable to lose through a misunderstanding, and the Admiralty explained to him that Howe, with a small squadron, was to have drawn the French fleet out into the open, where Hawke, with a larger force, could destroy them. He was persuaded to resume his command, but shortly afterwards ill-health compelled him to retire, and it was not until May 1759 that he was able to return to active service.



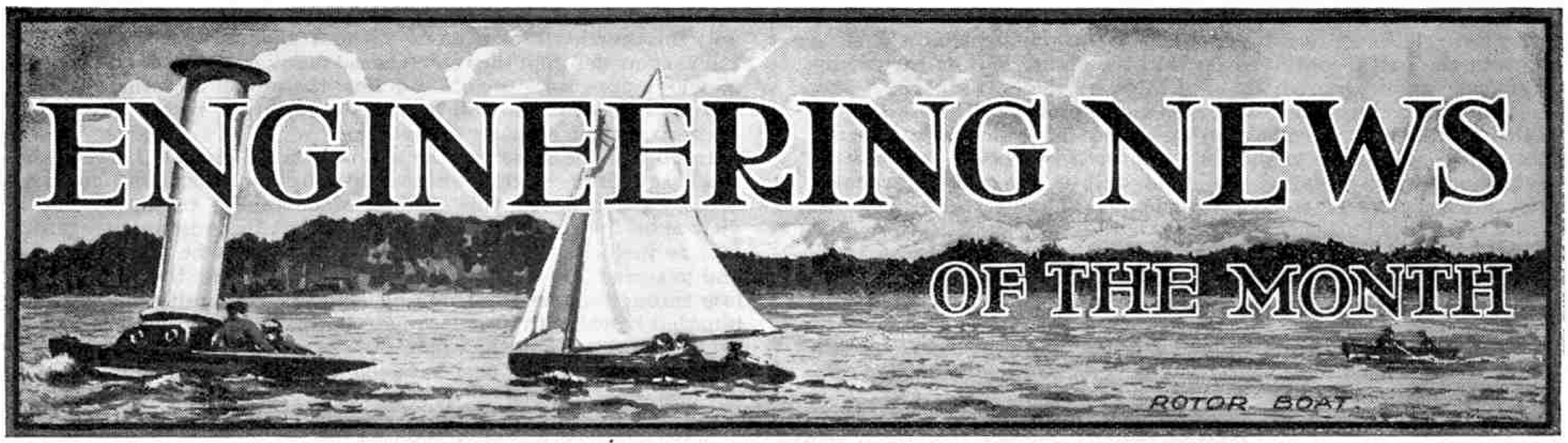
The "Terrible," of 74 guns, one of the French ships of the line captured by Hawke during the battle in the Bay of Biscay on 14th October, 1747.

France was then planning to invade England, and for this purpose a French fleet at Toulon was ordered to join the French Grand Fleet at Brest. Readers of our article on Admiral Boscawen in the "*M.M.*" of May last will recall that he was instructed to cruise off Toulon and prevent the French reinforcements there from leaving the harbour. Hawke was entrusted with the task of dealing with the French Grand Fleet at Brest, and with 25 ships of the line he left England to blockade the French port. This blockade was maintained for six months. Early in November severe gales forced Hawke to seek shelter at Torbay, and as the flagship "*Ramillies*," was leaking badly he transferred his flag to the "*Royal George*," of 100 guns. The fleet, without the "*Ramillies*," left Torbay on 14th November, and shortly afterwards Hawke learned from a lookout ship that the French fleet had escaped.

The enemy was sighted on the morning of 20th November about 40 miles to the west of Belle Isle, and when it became apparent to Admiral Conflans, the French commander, that his fleet had been observed, he put on all sail possible and headed for Quiberon Bay. This bay is full of dangerous shoals, but each French ship had a native pilot on board, while the English ships lacked this valuable aid, and Conflans hoped that this fact would deter his pursuers. Professor Geoffrey Callender, in his book "*The Naval Side of British History*," gives the following interesting description of the scene. "The day, which had opened with foul weather, grew worse, and the heavy French vessels lurched through the surges. There were but two or three hours of daylight left; and, as the storm fiends swung and whistled in the rigging, the rearguard began to envy those ahead. Hawke had never for a moment checked his speed; but now the chief navigator approached him and respectfully showed that, unless the British fleet turned about, it would ground itself on the unknown shoals and split itself upon the rocks. 'You have done right,' said the Admiral, 'in warning me of the danger. Now lay me alongside of the enemy!' And in defiance of shoals, and rocks, and darkness, in defiance of the gale and the merciless breakers, he clung to the coat-tails of the flying foe, and striking them dead to right and left, settled himself in a snug anchorage strewn with the wrecks of the battle-fleet destined for the conquest of Britain."

When daylight returned Hawke saw the "*Soleil Royal*" dismasted and anchored near by, and he immediately attacked her. She at once made off, but was pursued by the English ship "*Essex*," and to avoid further action Conflans ran his flagship aground. Unfortunately the "*Essex*" also ran aground, and, with the "*Resolution*," which appears to have grounded during the previous night, was subsequently abandoned and set on fire. The commanders of seven of the French ships

(*Continued on page 568*)



Express Road Re-laying Plant

An express road mending outfit that has been introduced in France is capable of re-laying in perfect order four miles of roadway in an hour, the road being ready for service a few minutes after it has been tarred. The outfit consists of three machines, the first being a motor tarring wagon provided with a furnace burning heavy oil. By means of compressed air the tar is forced from the boiler on to the road, and as it is almost vaporised there is no splashing when it comes into contact with the road surface. This machine is followed by a 22-ton gravel distributor, immediately behind which is a heavy motor road roller that presses the gravel into place. As soon as the road roller has passed over it, the newly surfaced road is ready for service. The tar does not soil the vehicles travelling over it, and gravel is not thrown up by the wheels to cause an unpleasant rattling under the mudguards. One of the engineers working with the plant says that the surface of the entire road from Paris to Calais, a distance of 185 miles, could be re-made in less than a fortnight!

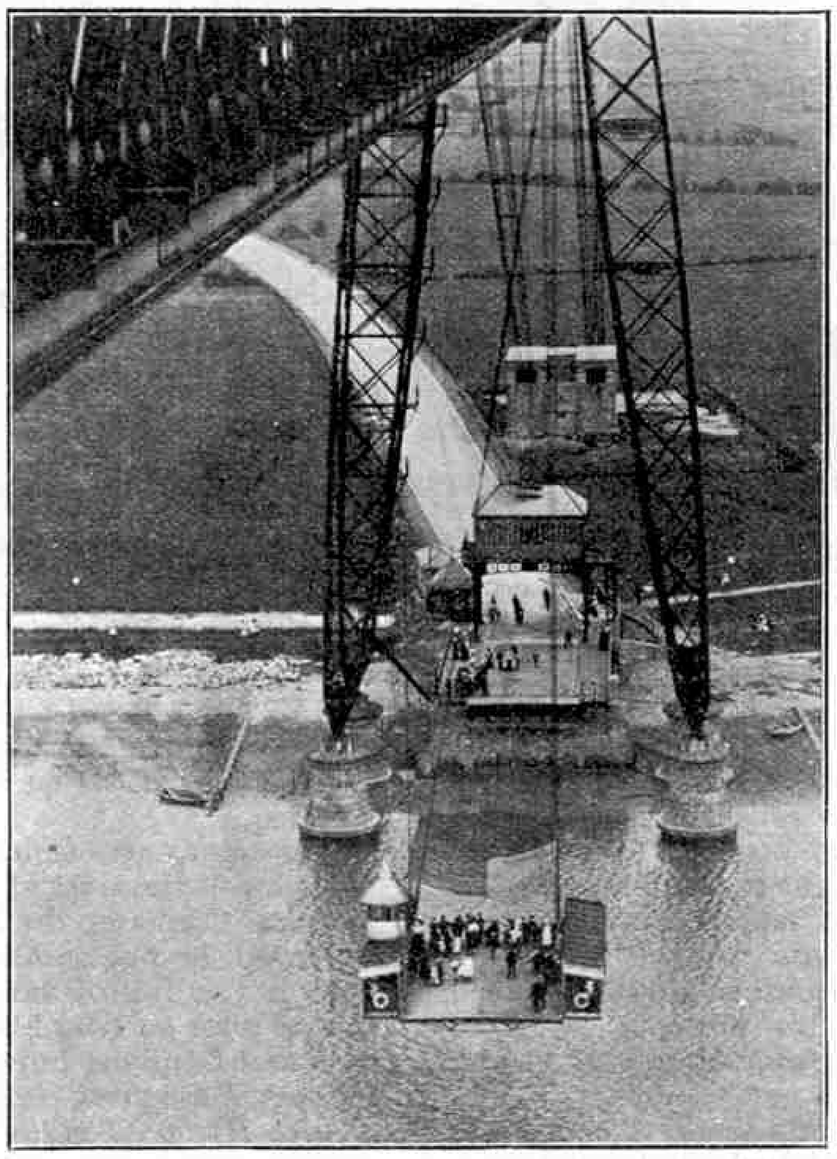
An Electrically-Welded Factory

A one-storey factory now being completed in London has been built without the use of a single rivet, electric welding having been employed throughout. By this means a saving in material of about 9 per cent. has been effected, and it is stated that if the factory had been heavier and of more than one storey, a saving of as much as 20 per cent. could have been made. The saving in the cost of the steelwork was 15 per cent. The factory covers an area of 4,060 sq. ft. The material was delivered at the site cut to size, and the items had merely to be laid out and welded together. The whole of the work was carried out by a single welder.

Pumping Station in Grand Canyon

There is a town in Arizona that for years has been receiving all its water by means of railway tank cars, although it is situated on the bank of a foaming, rushing river. The trouble is that this bank is nearly a mile high, for the river is the Colorado, and the town is on the rim of the Grand Canyon. Now the tank cars of the Atcheson, Topeka and Santa Fé Railroad, which have been hauling in an average of 70,000 gallons each day, can go elsewhere, for electric pumps are being installed under Westinghouse Electric supervisory control.

The pumping station is at Indian Garden Springs, 3,000 ft. below the rim of the canyon, where on a plateau within the canyon water is collected in a 70,000-gallon reinforced concrete reservoir. Other water from below the Springs is caught by a submerged dam built at the lower end of the plateau, 200 ft. below the reservoir and 2,000 ft. distant, and is pumped to the reservoir. In the main pump house four 17-stage vertical, centrifugal turbine-type pumps are used, each driven by a 60 h.p. 2,300-volt squirrel-cage induction motor. Each pump is capable of a vertical lift of 1,700 ft., and two pumps operate in series.



View looking down on the car of the transporter bridge at Newport, Mon. An article on Bridges of the transporter type appears on page 506 of this issue.

Three-phase current for the motors is supplied from a power house on the rim.

The site of the pumping station is difficult to reach, and is accessible only by a narrow trail down the cliffs; and a series of four cableways had to be built to transport materials. The isolated position, combined with the nature of the pumping station, made it undesirable to keep an operator on duty for starting and stopping the pumps and operating the valves. The station, therefore, is normally unattended, and is completely controlled by a man in the power house on the rim. This operator receives continuous electrical indications of all that is happening at the pumping station, and thus is able to adjust his controls in accordance with actual conditions. A thermostat is coupled to lamps on the operator's panel to guard against freezing.

Britain's Largest Steam Turbine

A new 105,000 Kw. turbo alternator set that is to be installed in the Battersea station of the London Power Company will have the distinction of being the largest unit yet built or under construction in this country. It will in fact be of 40 per cent. greater capacity than the previous largest set. The contract for the complete unit, including turbine, alternator, condensing plant, feed heaters and auxiliaries has been placed with the Metropolitan Vickers Electrical Co. Ltd. of Manchester.

The turbine will be of three-cylinder impulse type and will be designed for initial steam conditions of 575 to 600 lb. per sq. in. at a total temperature of 850°F. The low-pressure cylinder will have a double flow exhaust and the unit will run at 1,500 r.p.m. The main generator will have a maximum continuous rating of 100,000 Kw. and will be wound for 11,000 volts. A service generator of 5,000 Kw. 3,000 v. will be directly coupled in line, and the overall length of the entire unit, including turbines, main generator and exciters, will be about 120 ft.

A Huge Drying Cylinder

What is claimed to be the world's largest cylinder is now in use at a paper mill at Keynsham, Bristol. The cylinder is 64½ tons in weight, 14 ft. in diameter and 22 ft. in length over the bearings. It was transported by rail from Bury to Keynsham, and during its progress from the station to the factory, on a special lorry hauled by two engines, iron plates had to be placed on the road. The cylinder is a machine-glazed drying cylinder and is used in the making of paper and the production of paper bags. It is capable of making 7,500 tons of paper a year.

Water Grid for Yorkshire

A proposal has been made that water for Hull, and for various towns and villages in the plain of York, should be provided by Bradford Corporation by means of a "water grid" scheme. The grid scheme provides for the construction of a 27 in. pipeline from the Nidd Aqueduct, in the Nidd Valley, to a special service reservoir to be constructed on Garrowby Hill. This would be capable of holding 20,000,000 gallons of water and would supply the City of Hull, and Malton, Driffield, Beverley, Market Weighton, Stamford Bridge and other places. The pipeline would not stop at this reservoir, however, but would be continued to a service reservoir in an agricultural district, with a capacity of 2,000,000 gallons. It has been estimated that the scheme will cost £430,000.

Electricity in he Polar Regions

A hydro-electric power undertaking is now in progress on the Kola Peninsula in the north west of Russia, which is well within the Arctic Circle. In this neighbourhood there have been discovered rich deposits of apatite, a mineral from which is obtained phosphoric acid, and also of nepheline, which is used in the manufacture of aluminium. The Soviet Government have been exploiting these deposits experimentally for the last two years, and power for the work has so far been provided by a steam power station. A town of about 40,000 inhabitants has now sprung up, and power for mining the deposits and carrying on the various associated manufacturing processes is now to be generated by three hydro-electric stations.

The first development stage of the scheme provides for the construction of a power station with a capacity of 60,000 kw. on the Niva River. The annual rainfall on the Kola Peninsula is low, but there are many large lakes and marshes to provide the necessary water. Lake Imandra, which has an area of more than 300 square miles, is to be used as a reservoir for the first station. The head between Lake Imandra and the White Sea is 425 ft., and the three stations are to be built with heads of 50 ft., 120 ft. and 255 ft. respectively. They will have a total ultimate capacity of about 150,000 kw.

The station now under construction is the one at 120 ft., and is expected to be ready for service by the end of the year. The barrage that is to be built across the Niva River will consist of earthen dams 45 ft. in height, on each side of flood openings made of concrete and founded on rock. Water will be obtained from Lake Pinosero, which has an area of eight square miles, and it will be carried to the power station by a head race 2¾ miles long. About 2,000 men are already employed on work in connection with this station.

When all three stations have been completed, the two lower ones will be used to meet normal requirements, and the uppermost one, nearest to Lake Imandra, will serve as a peak load station.

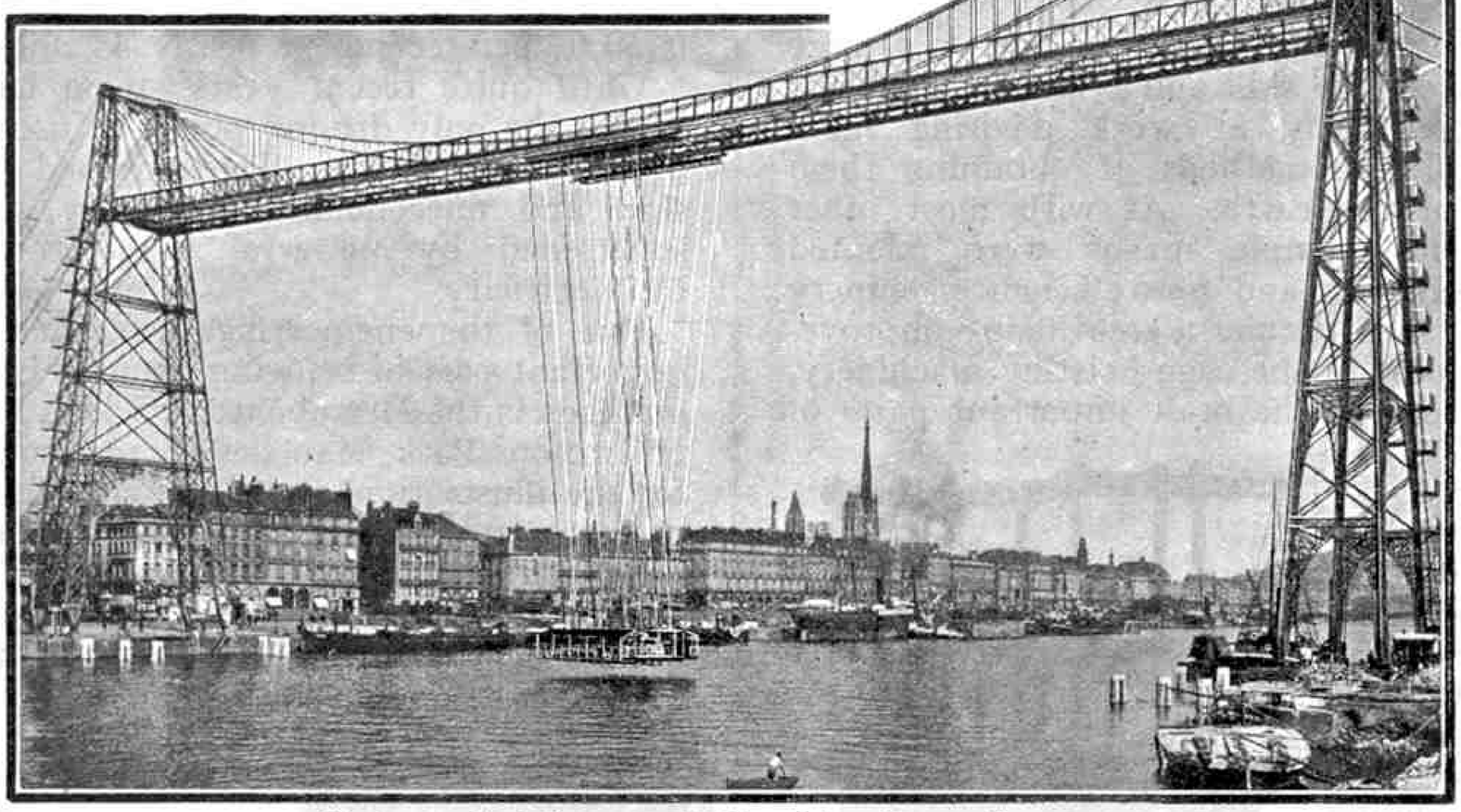
Important Bridges for Denmark

Two bridges are to be built in Denmark to form a direct connection between the islands of Zealand and Falster. The bridges will span the Magnedsund Strait between Zealand and the Island of Masnedo, which is about one-eighth of a mile in width, and the Storstrommen, which separates Masnedo and Falster, and is about two miles in width.

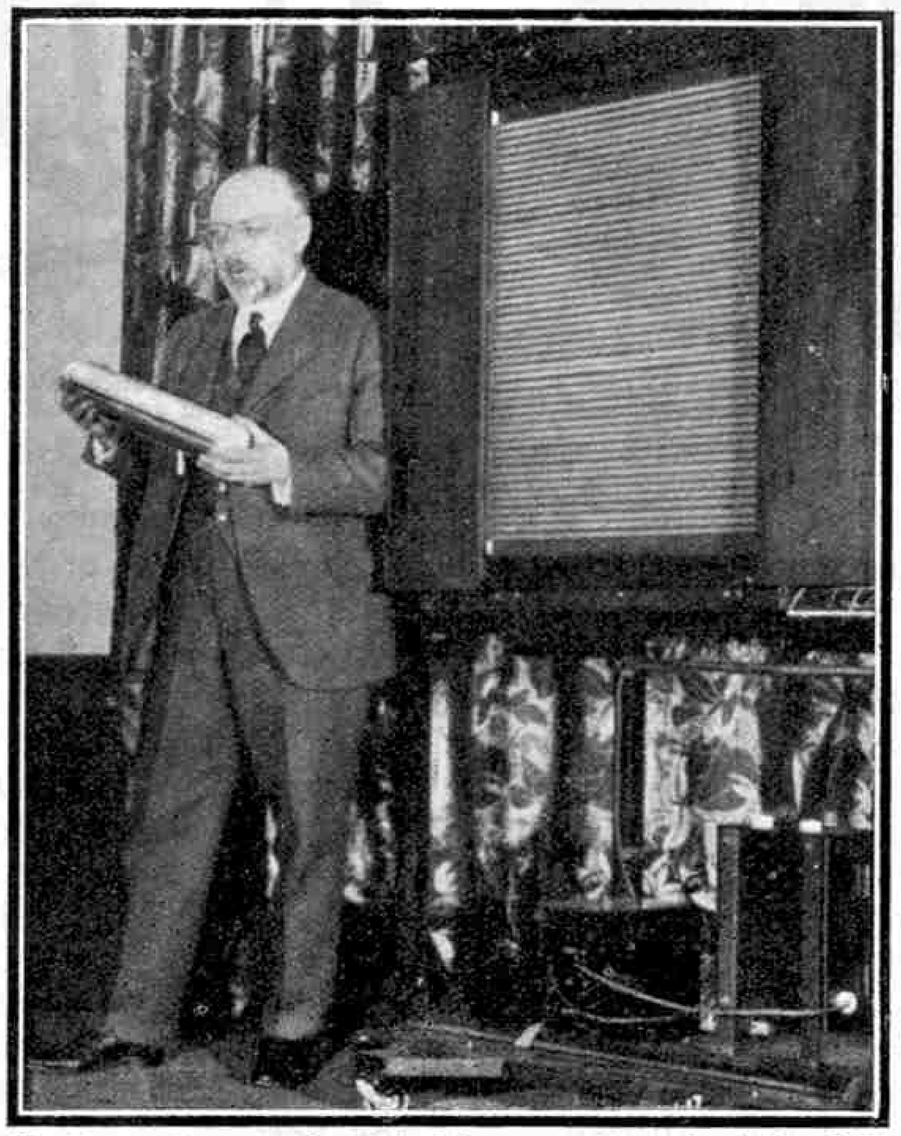
Both of the bridges will carry a roadway that will be about 18 ft. 6 in. in width between kerbs, a footway of 8 ft., and a single track railway. The Storstrom Bridge will have about 50 spans and the deck will rise towards the centre from each side at a gradient of about 1 in 150, so that there will be clear headroom for shipping of about 85 ft. at each of three navigation spans in the centre. The middle one of these will be 450 ft. in width between piers and the two side spans will each be 340 ft. in width. The remaining 47 approach spans will be 190 ft. and 204 ft. in length alternately. They will be of the cantilever type, and will have suspended spans and anchor arms situated in alternate openings.

The Magnedsund Bridge will have six spans, each about 100 ft. in length. One of these will be an opening span of the fixed trunnion bascule type.

Dorman Long and Co. Ltd., of Middlesbrough, are building the bridges, in the construction of which more than 30,000 tons of steel will be used. It is interesting to note that most of this will be Dorman Long's new high tension "Chromador" steel, which was described in the "*Engineering News*" of our last month's issue. The use of this steel has considerably lessened the estimated cost of the bridges.



The transporter bridge across the River Seine at Rouen, France.



Dr. Ives, who supervised television research work at the Bell Telephone Laboratories, New York. The picture was taken in the studio of the American Telephone and Telegraph Company, New York.

New British Radio Station

Many readers will no doubt have listened to the new B.B.C. West Regional Station at Washford Cross, Somerset. This station, which has two transmitters, has replaced the existing Swansea and Cardiff transmitters, and corresponds closely in design to the Scottish Regional Station at Falkirk. The power is provided by four 420 b.h.p. Crossley oil engines coupled to 230 volt D.C. generators, each of 245 kw. capacity. Motor generators also are provided to convert the 230 volt. D.C. supply to the voltages required by the two transmitters.

Each of the two transmitters, which broadcast the National and Regional programmes, employs 20 valves, and spare valves are provided so that they can be brought into use in the case of valve failure. The station is equipped with two aerials of the umbrella type. Each of these consists of three radial conductors that are suspended from lattice masts 500 ft. in height. Aircraft warning lights are attached to the top of each mast.

Giant Forging Presses

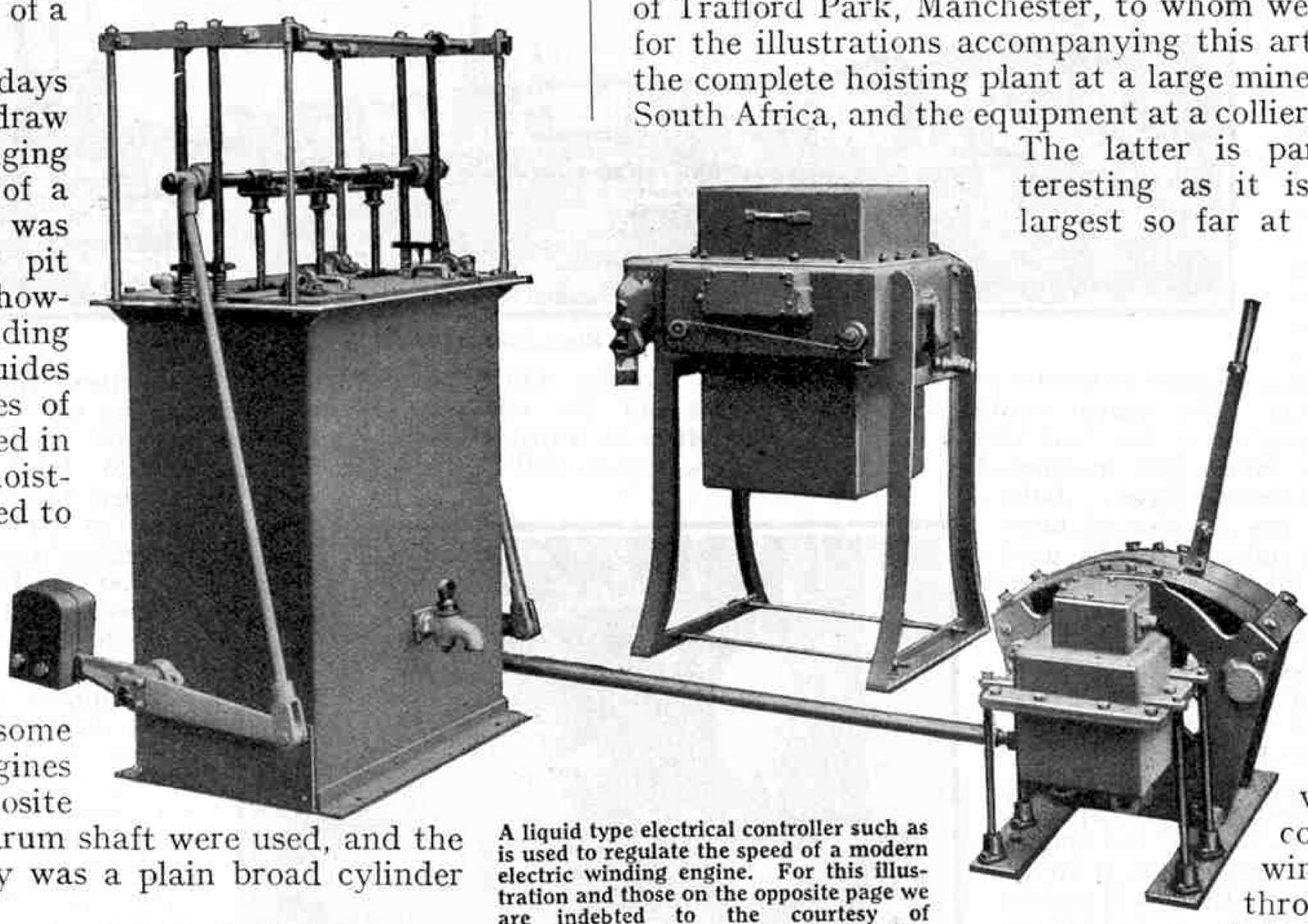
Two giant forging presses each capable of exerting a pressure of about 10,000 tons have been constructed by a German engineering firm. The feature of the presses is that although other machines capable of exerting as much and even more pressure have been built in the past, the new machines are capable of being used for a much wider sphere of action, and consequently are much bigger. They can be employed for forging drums for high-pressure boilers, turbine drums, ships' propeller shafts, guns and other articles up to 250 tons in weight. The presses are each about 50 ft. in overall height from floor level, while the lowest point is in a pit about 21 ft. below floor level, and they can forge turbine drums 14.7 ft. in diameter by 65.6 ft. in length. An interesting feature is that each machine has three hydraulic ram cylinders, so that the central ram, the two side ones, or all three, may be used according to the pressure required.

3,000 H.P. Electric Winding Engines

High-Speed Modern Mining Machinery

SINCE the use of coal and other minerals on a large scale commenced, the skill and brains of engineers have been constantly at work devising more economical and efficient methods of obtaining them from the depths of the earth. As with most other engineering problems, simple means were adopted at first, but gradually more and more efficient machinery has been evolved. In particular a great many improvements have been made in the cage hoisting machinery, which probably is one of the most important parts of the power equipment of a modern mine.

In the very early days it was the custom to draw the coal in tubs swinging freely from the end of a drawing rope that was lowered down the pit shaft. Nowadays, however, steel cages sliding between fixed guides placed down the sides of the mine shaft are used in place of the tub, the hoisting rope being attached to the top of the cage. Formerly the winding engine consisted of a direct-acting steam engine with a heavy fly-wheel. In some instances two engines coupled to the opposite ends of the winding drum shaft were used, and the winding drum usually was a plain broad cylinder with flanged rims.



A liquid type electrical controller such as is used to regulate the speed of a modern electric winding engine. For this illustration and those on the opposite page we are indebted to the courtesy of Metropolitan-Vickers Ltd., Manchester.

In many mines the pit shaft is divided into two semi-circular compartments by means of a steel lattice-work structure and the cages generally are 4-ft. broad and of a length and height of about 12 ft. This size of cage usually contains two decks for the trucks, although cages of greater height fitted with three or four decks are in use. The miners who travel up and down in the cages are protected by a roof over the top deck and gates fitted at the deck ends. At the top of each cage a short length of chain leads off from each corner, and the various lengths are joined together by a shackle to which the winding rope is attached. The winding ropes pass up from the tops of the cages to large winding pulleys at the pit head, and after passing over these descend to the drum of the winding engine, which is housed usually in a building some distance away.

The speed attained by the cages in the shafts of the best-equipped English collieries is very considerable, and in some cases is almost the speed of a railway train. For example, at a colliery in the Midlands the cage is raised from a depth of 1,548 ft. in 45 seconds, corresponding to an average of 35 ft. per second, or 24 miles per hour. The maximum speed when the cage is mid-way is 50 ft. per second, or nearly 35 miles per hour!

Until quite recent years steam engines were practically the only driving power in use for operating the hoisting machinery. This method is comparatively slow and uneconomical however, and is now being superseded by powerful high-speed winders driven by electricity.

One of the engineering firms that have played an important part in bringing about this change in mining methods is the Metropolitan-Vickers Electrical Co. Ltd., of Trafford Park, Manchester, to whom we are indebted for the illustrations accompanying this article, showing the complete hoisting plant at a large mine in Rhodesia, South Africa, and the equipment at a colliery in England. The latter is particularly interesting as it is one of the largest so far at work in this country.

The machinery consists essentially of a huge bi-cylinder conical winding drum driven by two 1,200–3,000 h.p. 500-volt D.C. motors, which are coupled to the winding drum through accurately machine-cut reduction gearing of the turbine type. The winding drum is 14 ft. in diameter at its smallest end, and at the largest end the diameter is 26 ft. These figures will give readers an idea of the enormous size of the plant.

In addition to the motors and the winding drum, the equipment includes engine-operated brakes, an electrical controller for the motor supply current, and a special type of depth indicator, which shows the exact position of the cages in the shafts during any part of the wind.

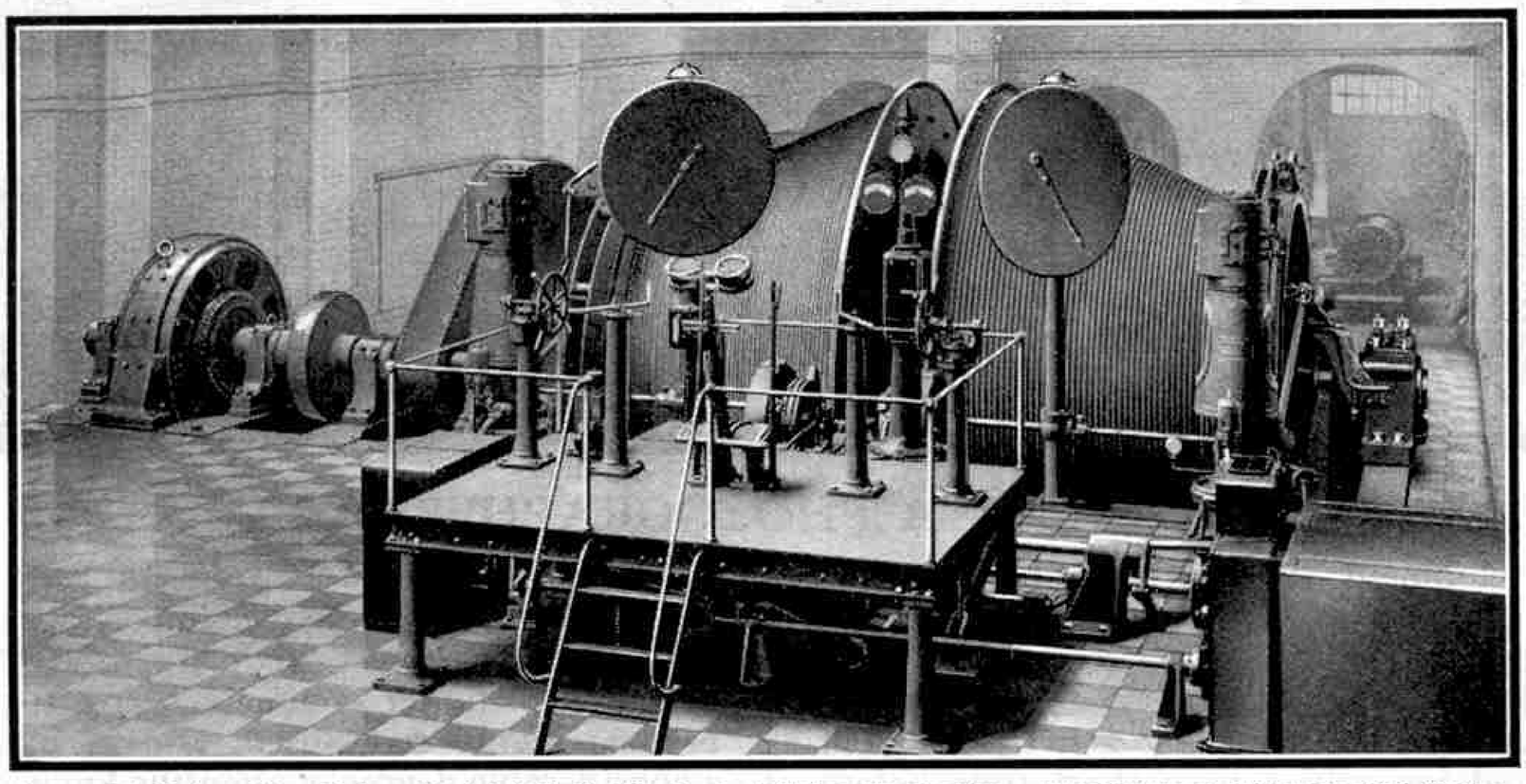
The Rhodesian plant has two motors of 275-425 h.p. and these are capable of winding a load of 6,000 lb. at a speed of 1,440 ft. per minute. The depth of the shaft at this mine is 1,500 ft., so that the cages are hoisted from the bottom of the shaft to the ground surface in little more than a minute.

These high rates of hoisting and lowering the cages necessitate elaborate precautions to ensure the perfect safety of the miners, and in the Metro-Vick plant, both electrical and mechanical means of controlling and braking the winding drums are employed.

In designing the various parts of the machinery, ease of manipulation and the safety of the miners have been

the chief aims, and to this end as few as possible rods, levers and other parts have been used.

The type of electrical controller fitted to the winding drum motor depends on the rate of hoisting, voltage of the motor circuits, and other local conditions. Usually, however, a special type of water controller with moving electrodes is supplied with the equipment. This apparatus has three moving electrodes connected together to form a neutral point, and three fixed electrodes. Each pair of fixed and moving electrodes is placed in an insulated tube containing a liquid termed the electrolyte, which is capable of offering resistance to the flow of an electric current. The speed of the winder motor is controlled by varying the distance between the electrodes, and so regulating the amount of the resistance and therefore the flow of current in the rotor circuit of the winding motor.

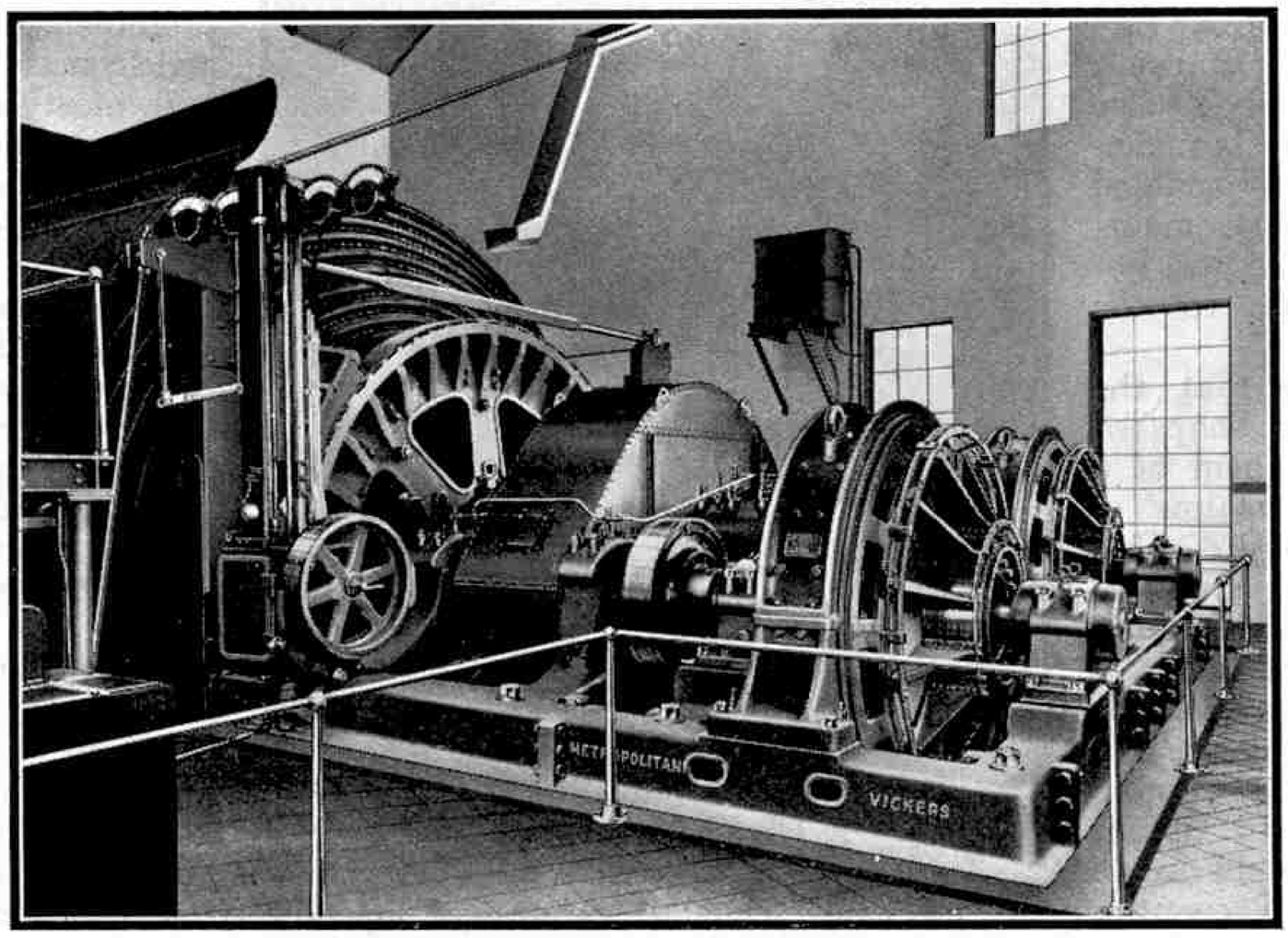


A complete Metropolitan-Vickers Electric Winding Engine installed at a large mine. The drums are driven by a 275-425 h.p. geared motor, capable of winding a net load of 6,000 lb. at a speed of 1,440 ft. per minute from a shaft depth of 1,500 ft.

The electrodes consist of groups of plates made from specially selected metal, and are arranged in two sets, one above the other. The lower set is the fixed set and the upper set is movable so that it can be raised or lowered, so varying the distance between it and the lower set. When the controller is in operation the electrolyte becomes heated by current passing between the electrodes. The hot liquid rises to the top of the resistance tubes, flows over the top, and then through a series of non-metal cooling tubes and so to the bottom of the tank. After cooling the liquid re-enters each resistance tube through a hole provided in the centre of a composition block, on which the fixed electrode is supported. The resistance tubes are contained in a tank made of welded boiler plate. Two sheet iron cover plates give access to the interior, and removable side plates give access to terminals provided with sockets to receive the incoming cables.

The operating mechanism is simplicity itself and includes no chains, wire ropes, or gear wheels that might give trouble in an emergency. At each side of the tank malleable cast iron balance levers mounted with ball bearings are fitted, and one end of each lever is connected by a steel tube to the rod carrying the moving electrodes. At each of the other ends of the levers counterweights are fitted, and these balance the weight of all moving parts of the controller so exactly that finger pressure is sufficient to move the electrodes up or down.

The resistance liquid or electrolyte consists of a solution of common washing soda, chemically known as sodium carbonate, in water, in the proportion of one part of soda to 20 parts of water.



Another fine example of a Metro-Vick Electric Winder. The massive brake sheaves and part of the control gear can be seen to the left of the illustration.

The controller is operated by means of a lever arranged to work in a frame either on the gate-change principle, such as is often used in motor vehicles, or on the ordinary straight-through principle of operation. A trigger catch is provided to lock the lever in the "off" position, and to prevent accidenta movement into either forward or reverse positions.

Another type of controller consists of a tank having a number of suspended electrodes, each of which is electrically connected to the slip rings of the motor. A small motor-driven pump circulates fluid electrolyte through the tank, and the winding motor is started by means of a sliding weir, movement of which varies the level of the fluid in the tank and therefore the extent to which the electrodes are submerged. The driver has simply to throw over his lever operating the weir, and the rate of acceleration of the winding motor is then fixed by the respective capacities of the tank and pump.

Once the winder has been set in motion by means of the controller, and the cage has commenced its ascent or descent of the shaft, unless some means were adopted to prevent such a happening the cages would gradually gather speed until eventually

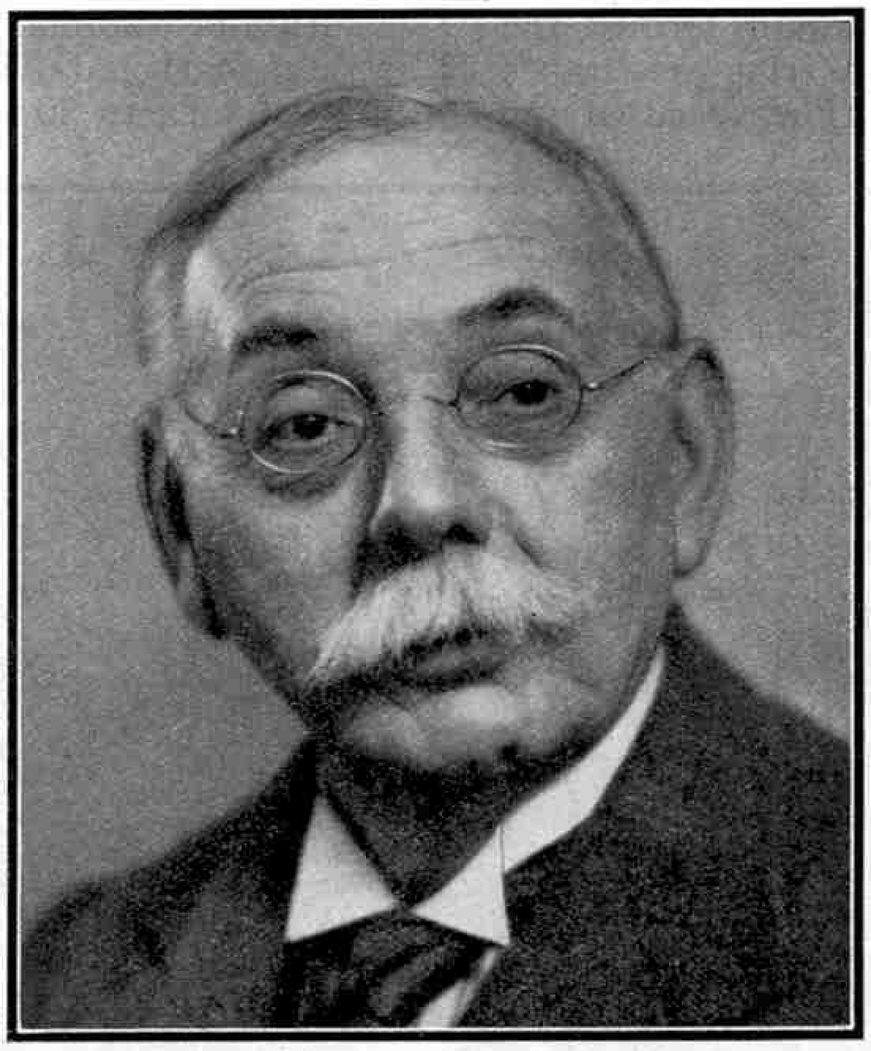
(Continued on page 553

XLIV.—A PHOTOGRAPHER

SINCE the development by Daguerre of the first photographic camera in 1839, there has been very rapid progress in the art of photography. The first photographs were naturally very expensive and were looked upon with suspicion by artists, while in addition they lasted for only a very short time before fading and becoming useless. Nowadays, less than a hundred years since Daguerre's discovery, photography has become an extremely important and popular feature of civilised life. It is difficult to imagine a daily newspaper without illustrations, while one of the most important accessories to any holiday is the handy snapshot camera. The camera has also been of great value to all branches of science, for it has enabled permanent records to be made, often of things invisible, or not at any rate apparent, to the naked eye.

Many boys imagine that the ability to take a good snapshot is sufficient to assure them of a good position in the realms of professional photography. This is not so, and although an early study of photography as a hobby may be extremely valuable, a recognised training is essential. There are many branches of the work and before beginning to think about how to obtain his experience, a boy should decide what exactly he hopes eventually to become. One of the most interesting branches of professional photography, and the one in which there is no likelihood of settling into a rut, is that of press photography. Photographers are employed by all newspapers and photographic agencies, and also by some magazines, while in addition there are many free-lance men who specialise in this work. For many years the other main branch of photography was portrait work, and this is of course still of great importance.

Another branch of photography that has come into prominence in recent years is commercial photography. This has come to the forefront with quite surprising rapidity, and it is being extended in directions that not long ago would have been thought impossible. To-day there is great scope for the commercial photographer who, in addition to technical skill, has initiative and ideas. Advertisers tend to turn more and more to photography to assist in selling their wares, but they demand a very high standard of work. By the nature of things commercial photography tends to become highly specialised, and in many of its phases a considerable degree of scientific knowledge is necessary. A man who specialises in the photography of furniture, for instance, must know a good deal about the different kinds of wood, and how to reproduce their characteristic features, and in addition he must know the special points in any type of article that must be brought into prominence, in order that the article may appear most effective and most attractive to the eye of the possible purchaser.



Mr. T. Lee Syms, J.P., F.R.P.S., President of the Professional Photographers Association of Great Britain and Ireland Ltd. Photograph by courtesy of Mr. F. Curson (Eccles).

The photographic profession may be entered upon in a variety of ways, of which the two most orthodox are to serve an apprenticeship with a photographer, or to attend a full-time course at one of the recognised schools of photography.

In regard to apprenticeship, it is difficult to give details, as conditions vary very greatly. It may be said, however, that as a rule the apprenticeship is for two or three years, and the premium varies from £100 to £200 or even more, in accordance with the status of the photographer. The value of an apprenticeship naturally depends to a considerable extent on the photographer, but at the same time it also depends largely on the apprentice. A really keen and enthusiastic youth will stimulate his instructor to open the stores of his knowledge and experience to a far greater extent than one who is less keen and is inclined to take things as they come. Perhaps the most important feature of an apprenticeship is the intensely practical nature of the instruction. From the first the apprentice is given definite jobs to do, and as he progresses from stage to stage and accumulates experience he acquires the confidence that goes far towards ensuring success.

The schools of photography that exist in London and in the provinces provide sound courses in practical and theoretical training in every branch of photographic work. They are equipped with up-to-date apparatus and fittings, so that a student becomes accustomed

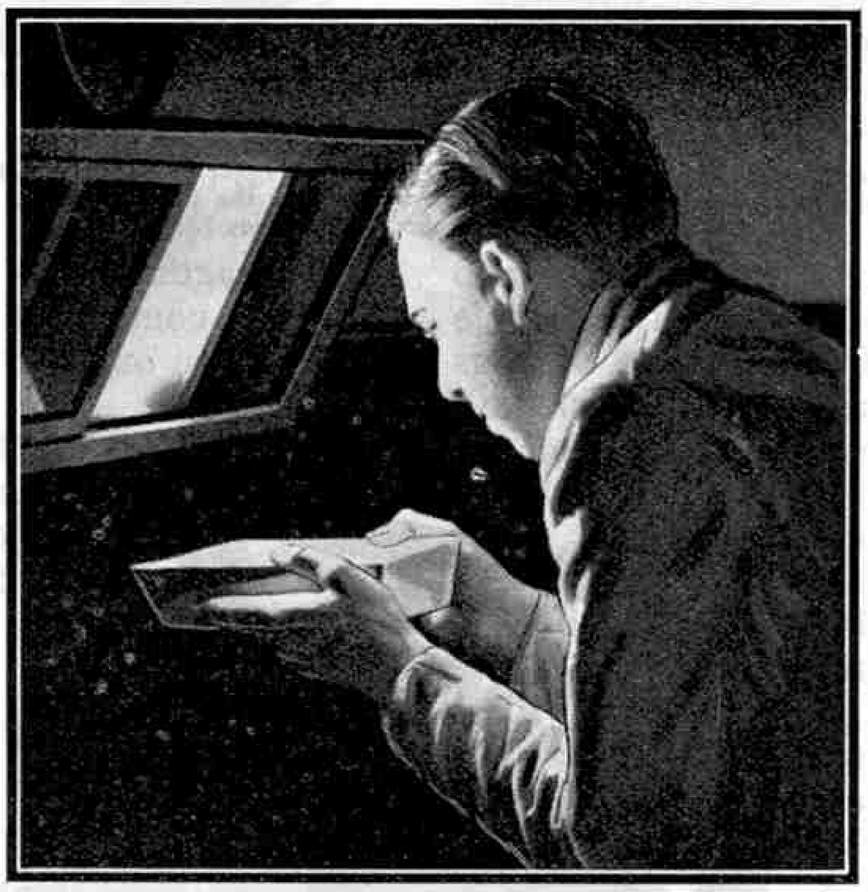
to handling and obtaining the best results from the latest types of apparatus. The instructors are always men who have had extensive practical experience, and in their teaching they aim at giving students an all-round equipment that will enable them to tackle any photographic problem with which they may be confronted when they commence work for themselves. The business side of the profession is not neglected, and instruction in efficient systems of book-keeping, negative storage, etc., forms an important part of the course.

Students at work in the chemical laboratory at the Regent Street Polytechnic School of Photography. For the photographs on this page we are indebted to Mr. Albert J. Lyddon, L.I.F.A., Head of the school.

A full course at one of these schools usually takes two years, and any student who completes it should be thoroughly capable of carrying out the duties of an assistant in a photographic studio.

In addition to courses in normal photography, instruction may be obtained also in kinematography. The first part of such instruction consists of a general study of photography, and it is followed by special instruction in the particular methods and problems of moving picture photography.

Press photography is in many respects the most interesting branch of the profession, but at the same time it is the most exacting. The man who has nothing more than technical photographic knowledge will never succeed in this work. The press photographer needs to have a "nose for news" as keen as that of the journalist; in fact he is a journalist who records in pictures instead of words. Unlike other photographers the press photographer cannot choose his conditions, but must just take things as they come. His opportunities come and go in a flash, and as a rule there is no possibility of a second chance. Speed is also an important feature of his work, and he must expect to have many thoroughly uncomfortable and strenuous days. To the man who is cut out for it, however, there is a special fascination about press photography, and the successful man is well paid.



Developing a negative in one of the dark rooms at the Polytechnic School of Photography.

Previously in this article we advised all those who are apprenticed to photographers and who wish to reach the highest position in the profession to attend evening classes in photography. Some evening schools have their own examinations, but if possible boys should attend schools where they can prepare for the examinations in photography conducted by the Department of Technology of the City and Guilds of London Institute. The Institute does not itself arrange any courses, its only object being to provide annual national examinations in photography, and other subjects, of a uniform standard for candidates in Great Britain and Ireland and the Overseas Dominions of the British Empire.

Students who intend to take the examinations are expected to attend classes for a period of four years, divided into two courses of two years. An intermediate examination is held by the City and Guilds of London Institute at the end of the second year, and at the end of the fourth year, a final examination on the result of which successful students are awarded first or second-class certificates according to the standard attained.

Before entering on the first year of technical instruction students who have left a public elementary school at the age of 14 should have attended for two years a part-time Junior or Preliminary Technical Course, where they should have studied English, calculations, drawing, and elementary science. Those who have received a full-time secondary education or its equivalent up to 16 years of age, need not attend such a course.

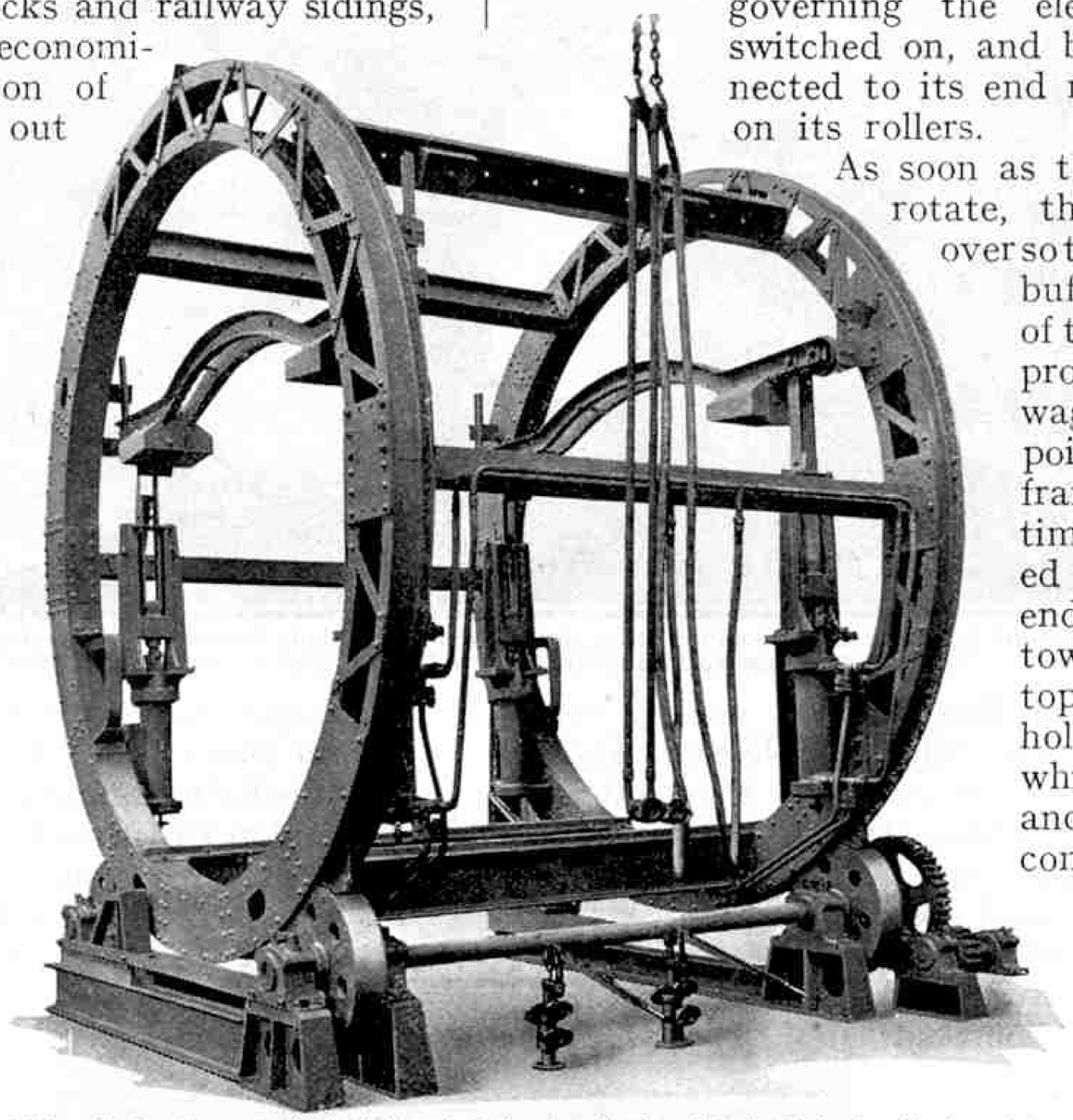
The standard and scope of the examinations in photography are governed by a special Advisory Committee that includes Members of the Royal Photographic Society and of the Professional Photographers Association, the two leading societies in the photographic world. The Advisory Committee on Photography recently completed a revised scheme of examinations and syllabuses in photography, and the scheme has been adopted by the Institute. This is published in pamphlet form, and all boys who wish to become photographers should apply to the Director, Department of Technology, City and Guilds of London Institute, 31, Brechin Place, South Kensington, London, S.W.7, for a copy of the pamphlet, which will be sent to them free of charge on receipt of a stamped addressed envelope.

High-Speed Wagon Tipping Plants

Modern Methods of Handling Bulk Minerals

WHEREVER large numbers of railway wagons containing coal or other minerals in bulk have to be handled, as at docks and railway sidings, it is of the utmost importance to economical working that the operation of unloading should be carried out as rapidly as possible, and to effect this many ingenious devices have been produced. Some of them accomplish the task by raising the wagon and tilting it sideways, thus allowing its contents to flow out, while other mechanisms are designed to tilt the wagon endways, so that the load is discharged through the swing door at one end of the wagon. The most popular tippler, however, is the rotary type, which completely inverts the wagon.

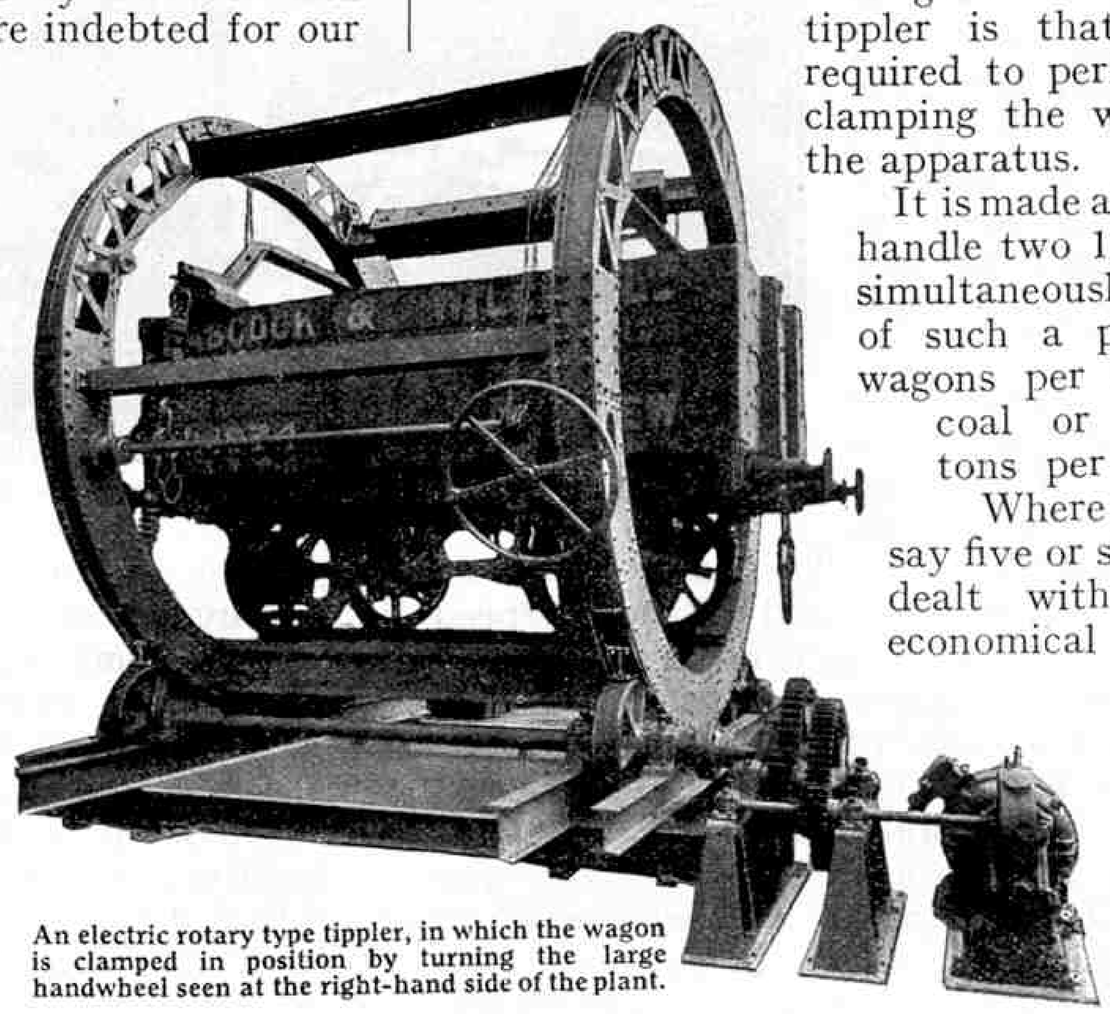
The various plants in use to-day include simple automatic tipplers operated by electric motors, hydraulic or pneumatic power, or where only small numbers of wagons have to be handled, by hand power; and huge combined tipplers and hoists, the purpose of which is to hoist wagons to a considerable height and discharge their loads down chutes into storage hoppers or locomotive tenders. In this article we shall deal only with simple tipplers. The various types of tipplers described are made by Babcock and Wilcox Ltd., London, to whom we are indebted for our information and illustrations. These plants represent the latest developments in this class of work.



Where hydraulic power is available, electric rotary tipplers fitted with hydraulic clamping gear, as shown here, are sometimes used. For the illustrations to this article we are indebted to Babcock & Wilcox Ltd., London.

The standard equipment made by this firm is known as an Automatic Rotary Tippler, and an illustration of it is reproduced here. Under normal working conditions the plant can handle 12 wagons per hour. The apparatus consists essentially of a cylindrical cage, on the base of which is a platform carrying rail track, the cage being set at such a depth below the ground that when it is in position to receive a truck its rails are at the same level as the running track of the siding. The cage is a built-up steel framework constructed from circular end rings connected by steel longitudinal members. The cage is mounted on rollers, and on its base is pivoted a cradle and tipping platform, on to which the wagon to be emptied is run. After the wagon has been run into the tippler, the controller governing the electric driving motor is switched on, and by means of gearing connected to its end rings, the cage is rotated on its rollers.

As soon as the tippler commences to rotate, the tipping platform tilts over so that the wagon rests against buffers provided in the sides of the cradles, and as rotation progresses the cradle with the wagon swings about its pivot point within the tippler framework. At the same time clamping bars, connected by links to the moving ends of the cradle, move towards and engage with the top of the wagon sides, thus holding the wagon securely while it is finally inverted and discharged. The motor controller is then reversed and the operations just described are carried out in the opposite sequence. The top clamping bar leaves the wagon, and the tilting platform returns to the horizontal position as the wagon comes into line with the siding, so that the wagon comes away from the side buffers and is free to be drawn out of the tippler by a locomotive or capstan.



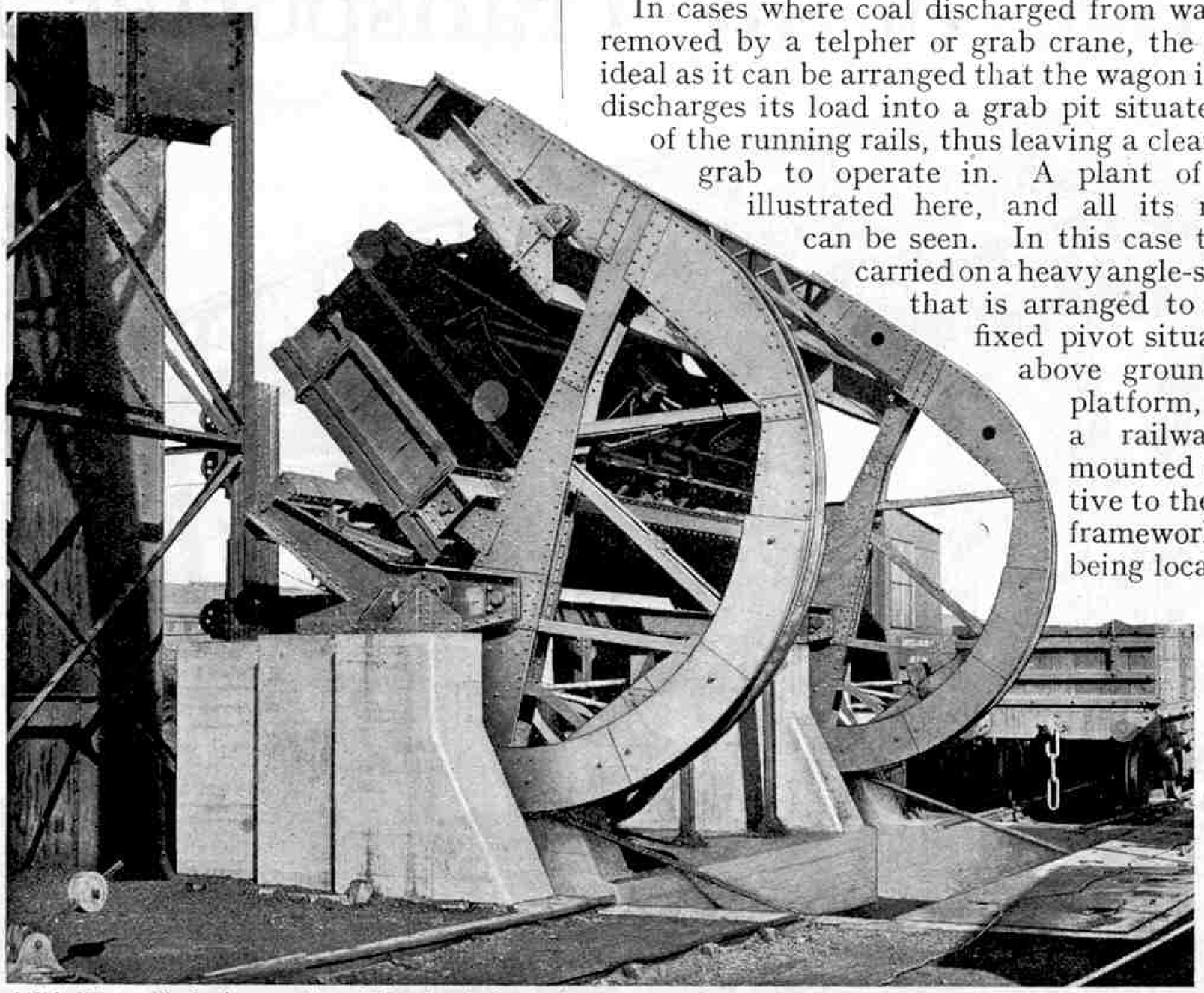
An electric rotary type tippler, in which the wagon is clamped in position by turning the large handwheel seen at the right-hand side of the plant.

A great feature of this type of tippler is that no attendants are required to perform the operation of clamping the wagons in position on the apparatus.

It is made also in twin form so as to handle two 10-ton capacity wagons simultaneously, the total capacity of such a plant being about 40 wagons per hour, or in terms of coal or other minerals, 400 tons per hour.

Where only a few wagons, say five or six per hour, have to be dealt with, it would not be economical to instal an automatically clamped tippler, and for use in such cases a tippler in which the wagons are clamped by hand has been designed. The apparatus will handle any class of

wagon, whether fitted with end-opening or side-opening doors. It is of the rotary type, and therefore is useful for handling wet or sticky materials that can only be discharged by completely overturning the wagon. As in the case of the automatic tippler, the cage consists of two steel end rings joined together by stout steel bars. This structure rotates on rollers, movement being imparted to the rollers by an electric motor; but instead of being positively driven by means of gearing, the cage is rotated simply by friction between the end rings and the driven rollers.



A Side Wagon Tippler in operation. This plant is fitted with an automatic clamping arm for securing the wagon in position and can handle 12 wagons of 12 tons capacity per hour.

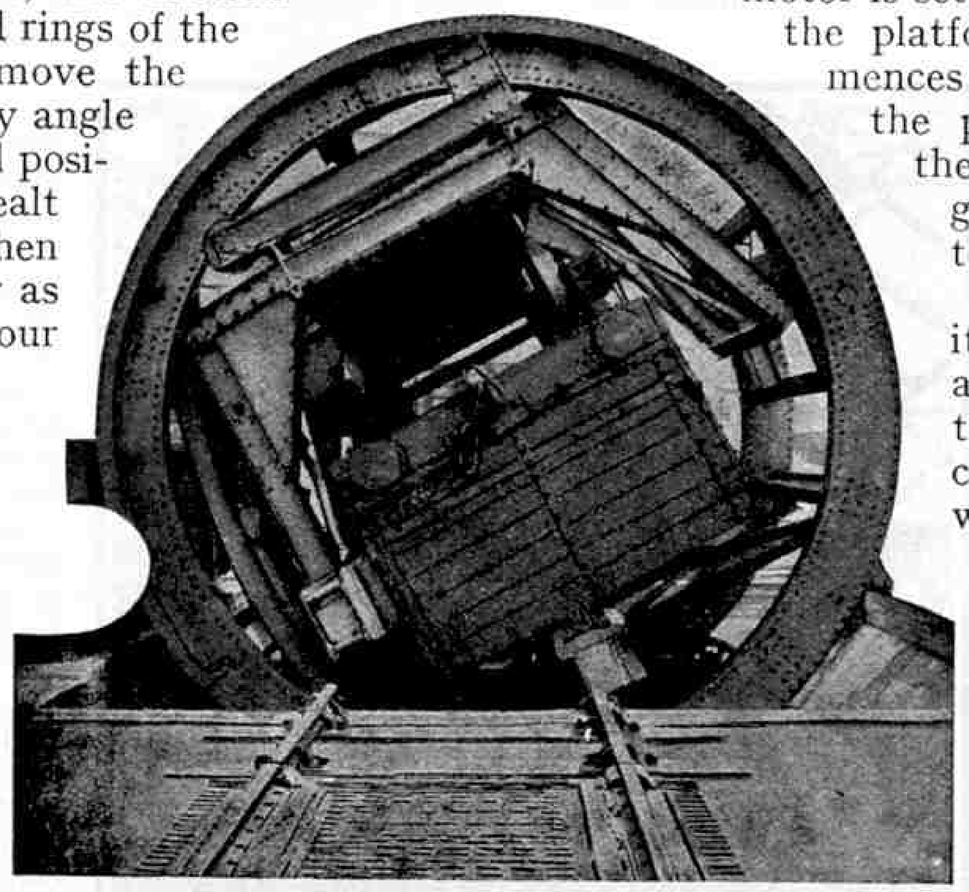
The method of operation is as follows. The tippler is brought to rest when the rails on the tipping platform it carries are in correct alignment with the permanent rails, by the application of a stop block attached to the framework. The wagon is secured firmly in position by two cross-bars, which are lowered across the top of the truck by means of a large diameter single handwheel that operates through worm gearing and wire ropes. Links and binding screws are then attached. The load in the wagon partially compresses the wagon axle springs, so that the binding screws are applied only with a light tension. When the truck is secured in position the electric motor is started and the rollers revolve, the friction between the rollers and the end rings of the tippler being sufficient to move the wagon until it is tilted to any angle required, or even to an inverted position. Six wagons can be dealt with per hour by this tippler when fitted with hand-clamping gear as described, but 12 or more per hour can be handled by the application of mechanically operated clamping gear. An illustration of a rotary tippler fitted with hydraulically operated clamping gear is shown on the previous page.

None of the tipplers so far described is suitable for the passage of a covered wagon or a locomotive, and in order to overcome this difficulty an electrically operated side tippler has been produced. With this plant either end or side-opening wagons can be handled with ease and discharged in a minimum amount of time.

In cases where coal discharged from wagons has to be removed by a telpher or grab crane, the side tippler is ideal as it can be arranged that the wagon in turning over discharges its load into a grab pit situated at one side of the running rails, thus leaving a clear space for the grab to operate in. A plant of this kind is illustrated here, and all its main features can be seen. In this case the platform is carried on a heavy angle-shaped framing that is arranged to swing about a fixed pivot situated some feet above ground level. The platform, which carries a railway track, is mounted pivotally relative to the angle-shaped framework, the pivot being located at a point off the centre of the railway track. The operating gear consists of a winch and hoisting ropes, which are brought from the underside of the angle frame, and pass round, and are fastened to, the ends of the frame. The ropes are operated by a winding winch, which is placed below ground level; and as the winding drum rotates, the ropes are drawn in and cause the angle-shaped framework and platform to move about its pivots.

An automatic clamping arm that normally is situated so as to clear a locomotive or covered wagon is provided. The arm is coupled to a horizontal lever that carries a balance weight, which rests on the ground when the platform is in the normal position for receiving a wagon. When a wagon is run on to the platform and the motor is set in motion, the angle frame carrying the platform and wagon immediately commences to rise, and owing to the fact that the platform is pivoted off its centre the wagon tilts sideways until it leans gently against side buffers fixed to the angle framing.

As the wagon is lifted still further, its top comes into contact with the automatic clamping arms, and as these are connected to the levers carrying the balance weight, the weights are lifted from the ground and hold the wagon securely on the rails on the platform while it is being turned over and inverted. After the load has been discharged the electric motor is reversed and the platform resumes its horizontal position; and in the meantime the clamping arms take up such a position that the track on



An automatic electric rotary tippler installed at a large power station. It is fitted with automatic clamping gear and can accommodate wagons of 40-tons gross weight.

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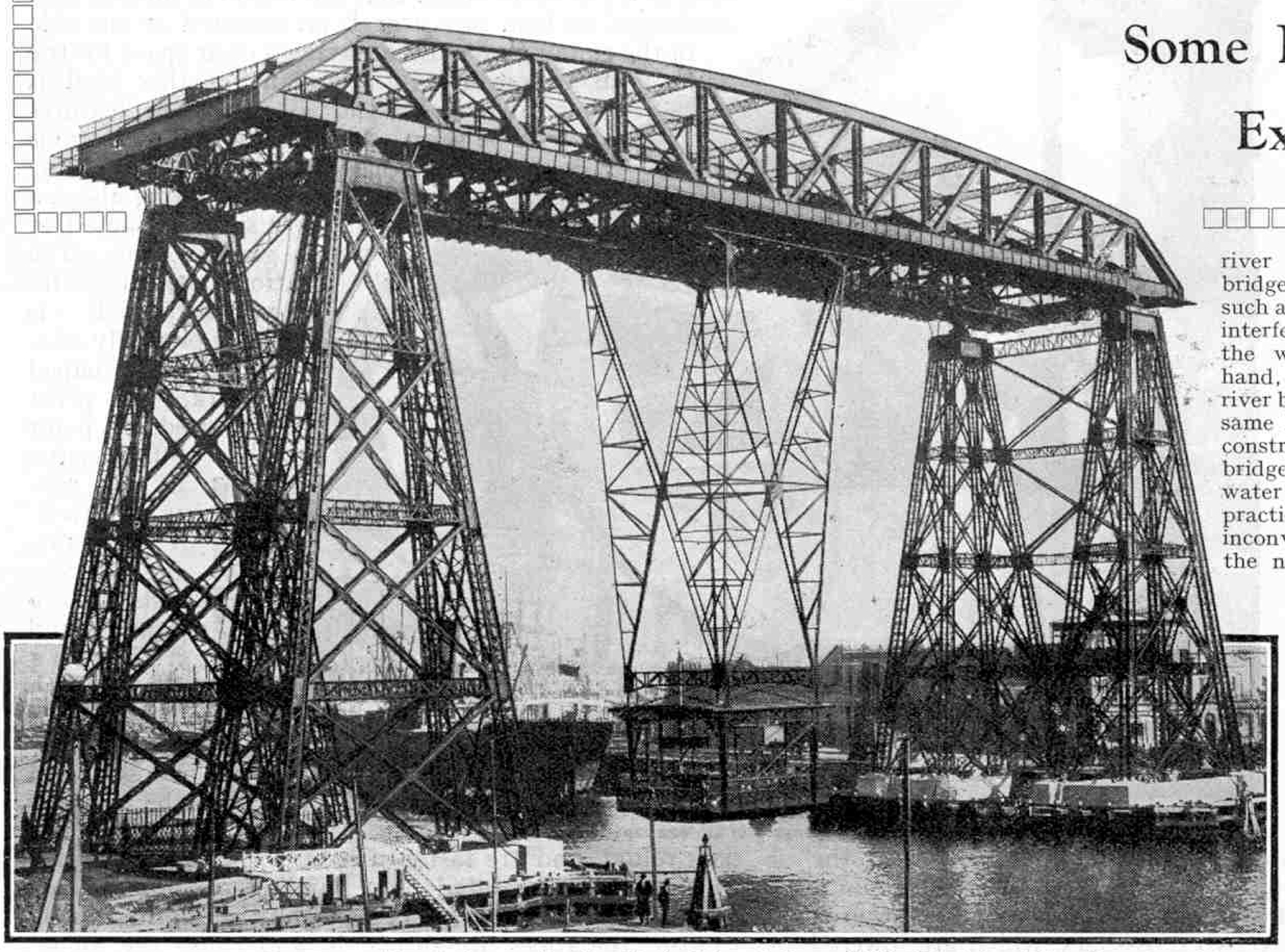
Bridges of the Transporter Type

Some Famous Examples



The Riachuelo Transporter Bridge, Buenos Aires, that crosses the River Riachuelo in a single span 854 ft. 3¼ in. in length from the centres of the towers.

THE building of bridges is one of the oldest and most important branches of engineering, and its history goes back to Roman times. Modern bridge-building dates from the later years of the 18th and the early years of the 19th centuries, when the famous engineers Rennie, Telford and Brunel built many important bridges of various types. The art has developed considerably since that period, and the many types of bridges now in use show how effectively and skilfully engineers have responded to the demands made upon them. They have even offered to bridge the English Channel between Dover and Calais!

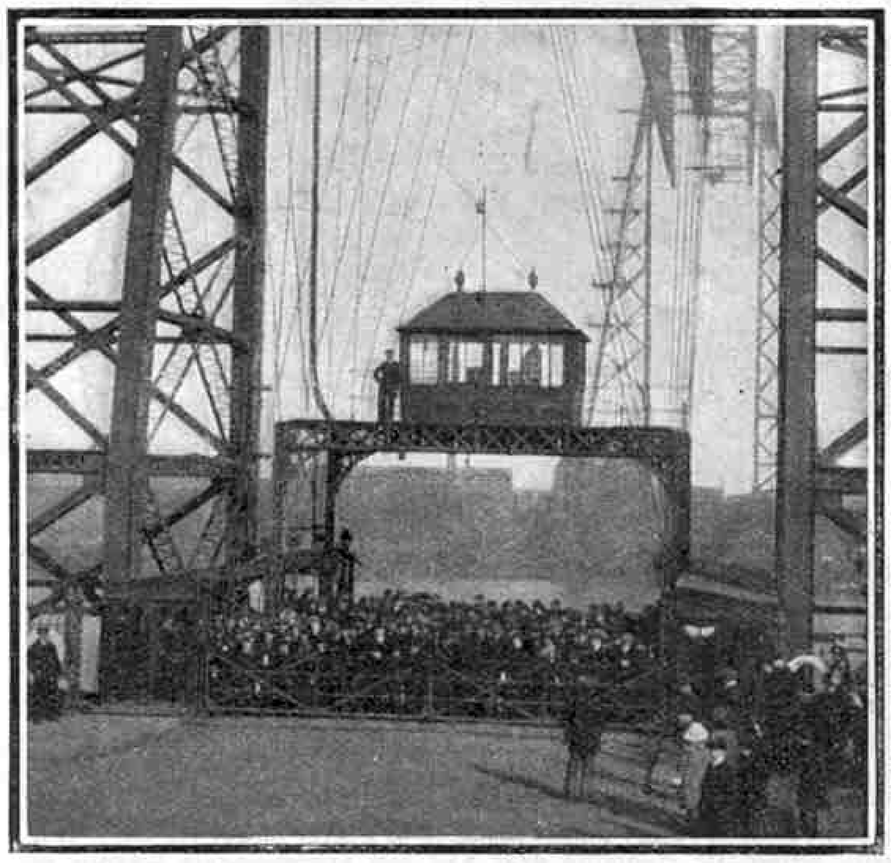
The different types of bridges of to-day include arched bridges of stone; cast or wrought iron girder bridges; cantilever bridges; suspension bridges; draw-bridges; and transporter bridges. Each type has some outstanding feature that makes it particularly suitable for some special and individual purpose.

The problems confronting a bridge builder are many and vary with each individual case. Because of this, nearly every bridge of importance embodies some original feature that is found in no other bridge, so it may be said that no two bridges are exactly alike. The Tower Bridge with its pair of bascules, the Forth Bridge with its mile-long roadway, and the high Menai Suspension Bridge are all "bridges," but each differs from the other in almost every particular owing to the peculiarities of the local conditions.

When it is desired to bridge a river the local conditions must of course be taken into consideration before the type of bridge can be decided upon. Should the river be navigable, the bridge must be placed at such a height that it will not interfere with the traffic on the water. On the other hand, in cases where the river banks are almost on the same level as the river the construction of a high bridge many feet above the water line is not always practicable, for the cost and inconvenience of building the necessary inclined approaches would be very great.

In some cases the difficulty has been overcome by the construction of swing bridges (as over the River Tyne at Newcastle), or draw-bridges (as in the case of the Tower Bridge over the Thames); but it may be said that the use of bridges of this type is confined generally to comparatively narrow rivers. Moreover, the steering of large steamers through the narrow opening of a swing bridge calls for considerable navigating skill, and if a strong tide is running at the time, there is considerable risk of the ship fouling the piers of the bridge. Consequently in certain places use is made of transporter bridges, and it is with this class of bridge that we are concerned in this article.

Transporter bridges consist essentially of a girder suspended at such a height that it clears the tallest masts, and rails fixed to this girder and carrying a trolley from which a car is suspended by steel cables. The car is moved across the river by steam or electric power, and the level of the car platform being the same as that of the approaches, the road traffic passes direct from the shore into the car, and vehicles and pedestrians are carried bodily across the river. The chief drawback to bridges of this type is the time taken in loading and unloading the car. Also, while the car is taking one load across, other road traffic may be held up until the car has completed the double journey. Hence it is improbable that transporter bridges will be made use of in the future except in places where the amount of road traffic is small.

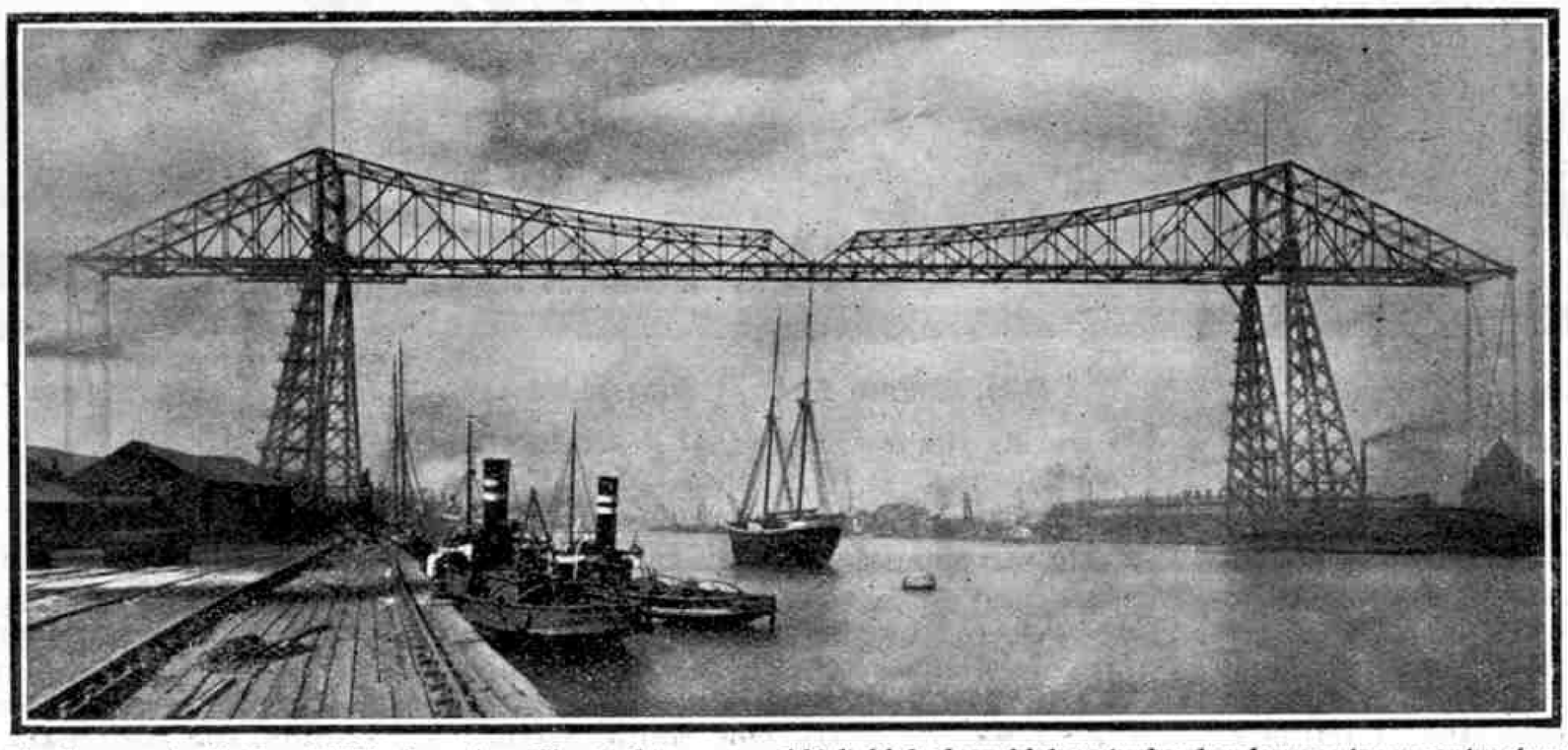


The car of the Middlesbrough Transporter Bridge.

The first transporter bridge was designed in 1872 to cross the River Tees at Middlesbrough. Two wrought iron towers were to support a superstructure of two cantilever frames and a central suspended span 320 ft. in length. It was to have a clear span of 650 ft. and was to provide a headway of 150 ft. for shipping. Owing to financial reasons, however, the bridge was

never built. For some years afterwards the transporter type of bridge remained more or less a novelty, until Palacio, an architect of Bilbao, and Arnodin, a French engineer, took out a patent for this system of bridge design. In 1893 they designed and erected a transporter bridge at Portugalete, near Bilbao, the main span of the bridge being 148 ft. above high water level and built in the form of a suspension bridge with "stiffening" girders. In 1897 a transporter bridge designed by Arnodin was erected across the River Seine at Rouen. It has a span of 472 ft. and is operated by electric motors fixed to the top of the car. The towers are 280 ft. in overall height.

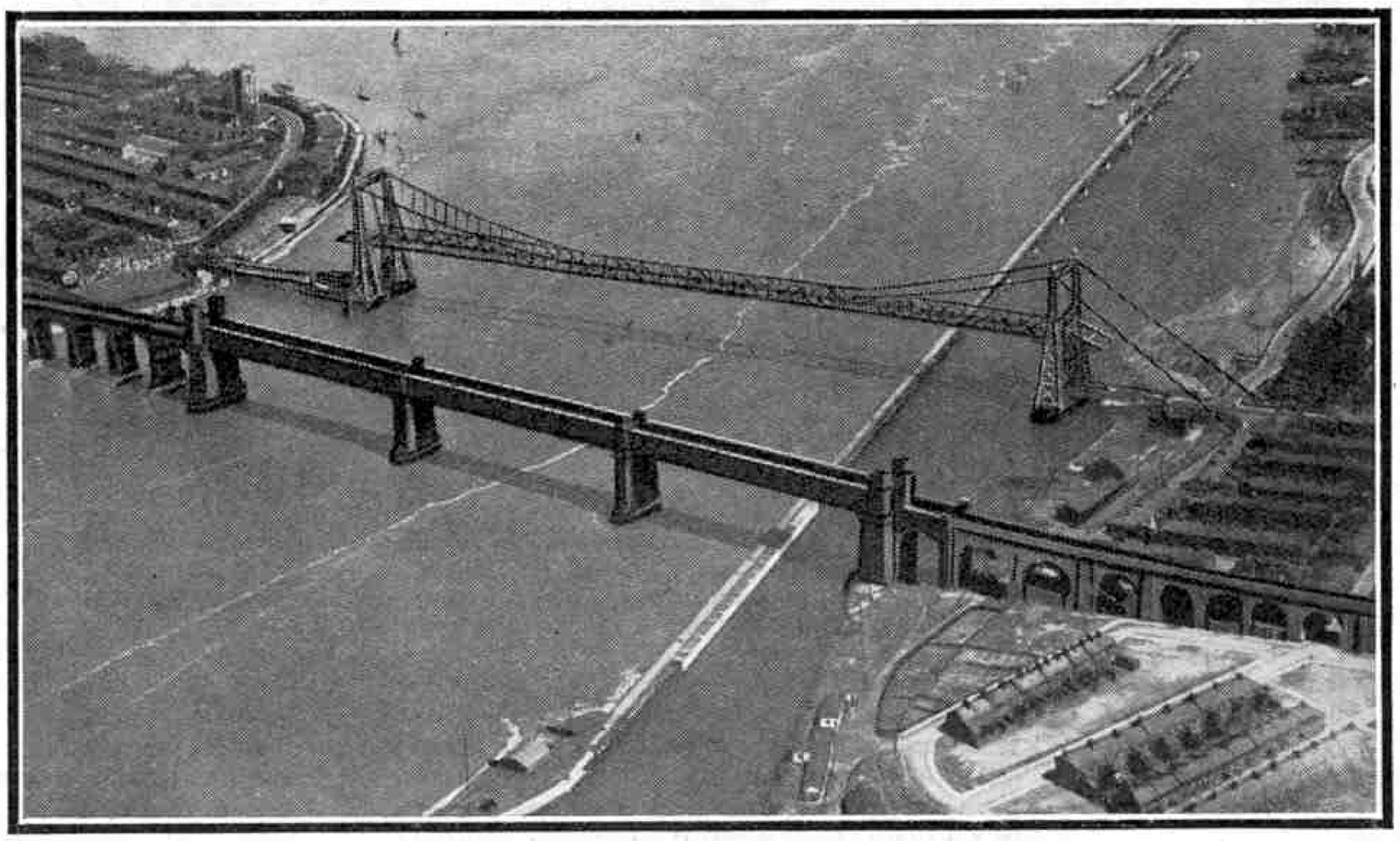
One of the most notable examples of a transporter bridge is that which crosses the River Mersey and the Manchester Ship Canal between Runcorn and Widnes, in a single span 1,000 ft. in length. This bridge was built in 1904, and was the first of its type to be erected in this country. It is an imposing structure, and the four cast iron towers, two at each side of the bridge, are 190 ft. in height above high-water level. Each tower is square in section, and has four braced legs resting on four cast iron cylinders 9 ft. in diameter. The towers carry the stiffening girders at a height of 82 ft., and the two suspension cables. These cables have a sectional area of 50 sq. in. and are immensely strong, each cable being made up of 19 parallel strands, every one of which contains 127 steel wires .162 in. in diameter. Similar cables extend downward from the tops of the towers to anchorages behind the towers.



The Transporter Bridge, Middlesbrough. The steel towers are 161 ft. high above high water level and support a superstructure of two cantilevers that meet in the centre of the span.

The transporter car is 55 ft. in length by 24 ft. in width, and can accommodate 300 people and four vehicles at the same time. It is propelled by two 36 b.h.p. electric motors and can average 10 trips an hour. The car is suspended from a trolley 79 ft. in length. It is built in five sections secured together by pins, and runs on the lower flanges of the stiffening girders. The cables holding the car are $1\frac{3}{4}$ in. thick and are spaced 18 ft. apart.

Two years after the completion of the Runcorn - Widnes Transporter bridge, a similar structure was completed across the River Usk at Newport, Monmouthshire. This bridge has a span of 645 ft. from the centres of the towers, and a clearance above high-water level of 177 ft. The two lattice steel towers rise to a height of 242 ft. above road level. They are supported on piers arranged in two groups of four, each containing about 19,500 cu. ft. of concrete and masonry. The towers have hinged legs, the bases of these being provided with inverted saddles that are connected through rocker pins to cast iron saddles on the tops of the piers. The two stiffening girders are 26 ft. 3 in. apart and 16 ft. in depth, and are suspended by 16 thick cables, eight inside and eight outside each girder. Each of these cables consists of 127 wires and is four tons in weight. Sixteen similar cables called "backstays" extend downward from the ends of the girders, and are held firmly in masonry anchorages at the rear of the towers.



The Runcorn Transporter Bridge, shown in the background, spans the River Mersey and the Manchester Ship Canal between Runcorn and Widnes. The single span of the bridge is 1,000 ft. long.

The transporter car is 33 ft. in length and 40 ft. in width, and is suspended by 30 ropes from a travelling trolley, 104 ft. in length, which runs along the bottom booms of the stiffening girders. The stiffening girders carrying the trolley are supported by 16 suspension cables, four on each side of each girder. Each cable consists of 127 wires and has a total cross-sectional area of 4.27 sq. in.

Another important transporter bridge crosses the River Tees and connects Middlesbrough with Port Clarence. Formerly communication between these two places was maintained by a ferry boat service, but with the growth of both localities increased transport facilities became necessary. The importance of maintaining a free passage for ships influenced the suggestions made for improving cross-river transport, and a lifting bridge, a swing bridge, and a tunnel under the river were among the proposals considered. Eventually a transporter bridge was decided upon as the best solution to the problem.

The Middlesbrough Transporter bridge was designed by the Cleveland Bridge Co. Ltd., and constructed by Sir William Arrol & Co. Ltd., and was opened by Prince Arthur of Connaught on 17th October, 1911. It has a span of 571 ft. The two pairs of steel towers rest on concrete foundations and are 161 ft. in height above high-water level. They support a superstructure of two cantilevers that meet in the centre of the span. These cantilevers are built up of braced girders, and are 65 ft. in depth over the towers and 21 ft. in depth at the centre of the span. On the landward side they overhang the steel towers by 140 ft., and are anchored down by steel cables, the lower ends of which are firmly secured in masonry foundations.

The transporter car has passenger cabins and a roadway for vehicular traffic, and can accommodate 600 passengers and one vehicle at the same time. It is suspended from a travelling platform that is pulled from shore to shore by steel ropes drawn by two electric motors in a winch-house on the south side of the river. In case of emergency the working of the bridge can be controlled from this cabin, but normally the bridge is controlled from a pilot-house on the transporter car.

So far we have dealt chiefly with transporter bridges erected in this country, but mention must be made of a remarkable bridge of this type at Buenos Aires, Argentine. This bridge crosses the mouth of the River Riachuelo near its junction with the River Plate. According to "*Engineering*," to which we are indebted for much of our information, the bridge was built to facilitate heavy road traffic to the Buenos Aires Southern Dock. Although the river is a comparatively small one there is considerable traffic on it, and at the time the bridge was built this included many sailing vessels, some with masts reaching to a height of 147 ft. above sea level. The bridge is not as high as this, (*Continued on page 553*)

Imperial Airways News

The African air mail service has now been accelerated by one whole day in each direction as the first stage in a general speed-up that will in due course enable the total air transit time of the service to be reduced by several days. The weekly flight to Capetown now occupies 10 days.

Under the new timetable, machines flying southward cover the 1,180-mile stage from Cairo to Khartoum in one day instead of in two, cutting out the night stop at Wadi Halfa. This means that air mail to Khartoum and places south of that point is expedited by one day, and that Capetown is reached on Saturday instead of Sunday as hitherto. On the northbound service themachinesafterleaving Khartoum cease to make a night's call at Wadi Halfa, and fly through in a day to Assuan, from which point the flight continues on the following morning through to Alexandria, instead of to Cairo, thus eliminating the train section between Cairo and Alexandria. This is accomplished by transferring passengers and mails direct from aeroplane to flying boat at Cairo, the flying boats operating from the River Nile and flying on to Alexandria.

Still another accelerated stage on the northbound service is that above the Mediterranean, the 960 miles between Alexandria and Brindisi now being flown in a day instead of two days, obviating the night's stay at Athens.

During the summer Imperial Airways are operating an air service every weekday between London, Basel and Zurich. The machine leaves the Croydon Airport at 8.15 a.m. and passengers arrive at Basel at 1.45 p.m. and are in Zurich at 3.0 p.m. Swiss train connections fitting in with the airway timetable enable various other resorts to be reached in a few hours, while rapid air connections are available with Italy and Austria.

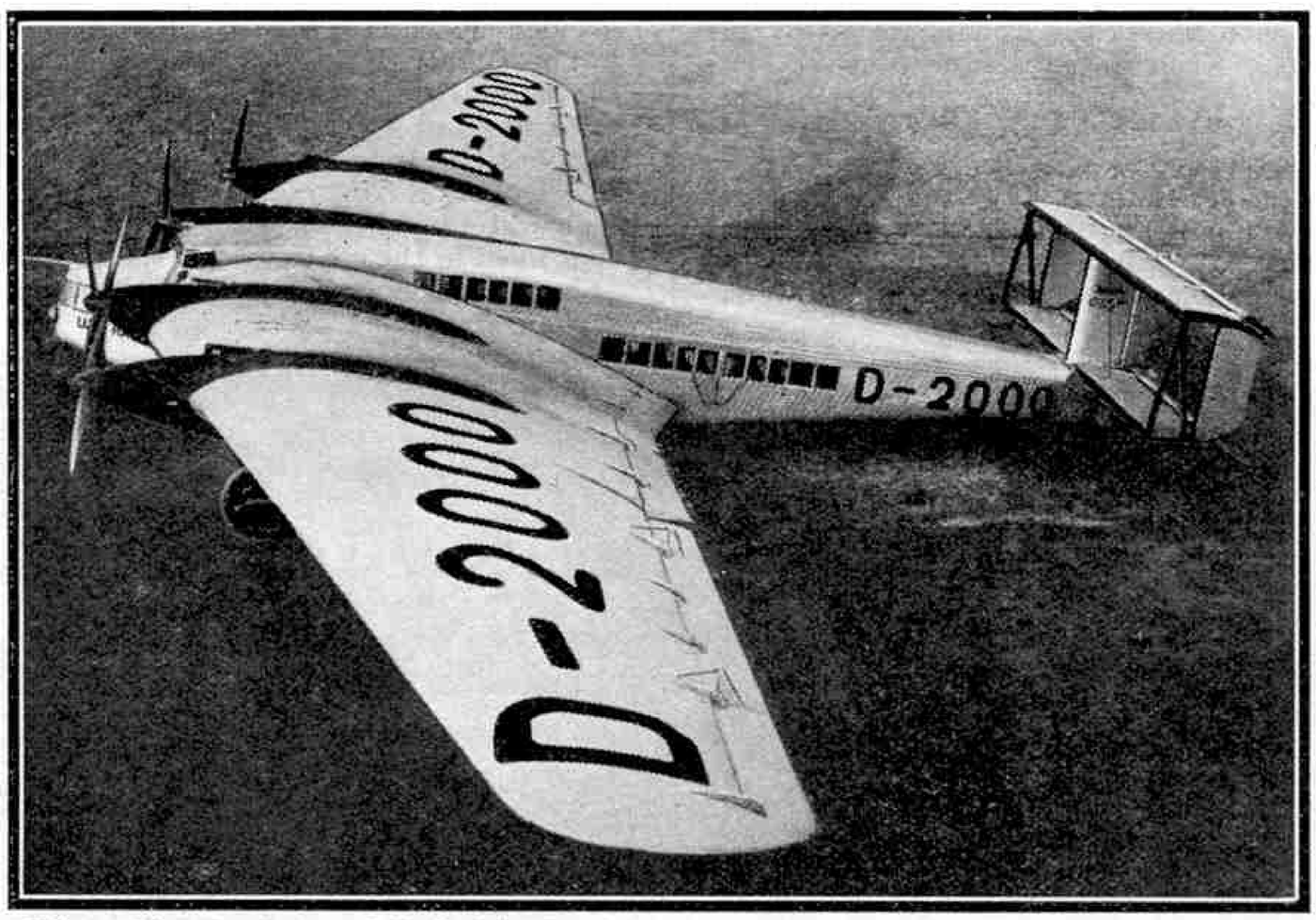
The service from Switzerland to London is timed to leave Zurich at 3.30 p.m. and Basel at 4.45 p.m., Croydon being reached at 10.15 p.m.

D.H. "Puss Moth" Superseded

During the few years that it has been in service, the D.H. "Puss Moth" has become one of the most popular light cabin aeroplanes in the world. It has been used for a variety of purposes, and was selected by the late Mr. Bert Hinkler for his flight over the South Atlantic, and by Mr. J. A. Mollison for his flights over both the North and South Atlantic.

The machine is now to be superseded by the D.H. "Leopard Moth." This will be similar to the "Puss Moth" in general external appearance, and will have accommodation for pilot and two passengers, in addition to a separate luggage compartment. It will be equipped with dual control, and wheel brakes and air brakes will be standard equipment. A D.H. "Gipsy Major" engine developing 130 b.h.p. will be employed. Construction will be mainly of wood, as this has been found to be both light and strong in the "Fox Moth" and the "Dragon."

The De Havilland Aircraft Co. Ltd. are at present at work on six "Leopard Moths" to be used for experimental and demonstration work. When these have been modified and improved as flying experience proves necessary, quantity production will be begun.



This machine, the Junkers G.38, is claimed to be the largest landplane in the world, and is employed on the London-Berlin service of the Deutsche Luft Hansa. The work carried out by this company is described on page 510. Photograph by courtesy of Junkers Flugzeugwerke, A.G.

A Wingless "Autogiro"

The latest Cierva "Autogiro," known as the Mark C.30 model, is a most remarkable looking machine, for it has no stabilising wings, and consists of a standard fuselage with three rotors supported above it on the customary "pylon." This machine, which is the culmination of a long series of experiments, is steered by tilting the rotors, the customary joystick and rudder bar of the ordinary aeroplane being dispensed with. The rudder and elevator have been eliminated, a fixed fin surface being provided, and the fixed tailplane being used for trimming the machine. Another unusual feature is that the wheels are placed directly below the engine, so that there is no possibility of the machine's turning over on to its nose after landing or when taxying. A tail wheel is provided to steer the machine when it is travelling along the ground.

Control of the machine is entirely obtained by tilting the rotors, the head being universally mounted for this purpose. Piloting this "Autogiro" is very similar to driving a motor car, and the inventor states that he may increase the resemblance by fitting an accelerator pedal for use in conjunction with the hand throttle.

An Armstrong Siddeley "Genet" engine developing 80 h.p. is employed in the machine, and this gives it a maximum speed of about 103 m.p.h. During a demonstration of the machine, carried out by Senor de la Cierva himself, vertical landings were made without any forward run, while in a race arranged between a man on the ground and the "Autogiro" carrying two passengers, the runner won easily. Another interesting demonstration consisted of delivering a parcel, on the end of a string to an assistant on the ground, who ran along and took the parcel off the string. The aircraft then made a circuit of the aerodrome, and the parcel was again hooked on to the string and pulled up on board the machine. This would be useful for the delivery of mails.

British Racing Monoplane

Two interesting low wing racing monoplanes have recently been designed in this country. These are the Comper "Streak" and the Hendy 3302. They were designed primarily to take part in a series of international air races that were to have been held at Portsmouth this summer, but unfortunately the meeting has been cancelled.

The Comper "Streak" has been developed from the Comper "Swift," but it differs in many respects, particularly in the fact that it is a low wing monoplane, while the "Swift" is of the high wing type. The fuselage is similar to that of the "Gipsy-Swift" that gained second place in the King's Cup Air Race last year. The wing is of the cantilever type, and has been set low on the fuselage in order to provide a good view when the machine is cornering. An interesting feature is that a retractable undercarriage is fitted in order to increase the speed. It is estimated that the "Streak" will have a maximum speed of about 200 m.p.h. and that it will land at about 65 m.p.h.

The Hendy 3302 is also a low wing monoplane, and its design is based to a certain extent on the Hendy 302. It is a cabin machine and wood is mainly used in the construction. The whole of the undercarriage is not retractable as in the Comper "Streak," but the struts are to be provided with streamlined "spats" into which it will be possible to lift the wheels immediately the machine gets into the air. Under these conditions the top speed will probably be more than 200 m.p.h., and it is claimed that the landing speed will be less than 60 m.p.h. Photographs of these machines will be published as soon as they are available.

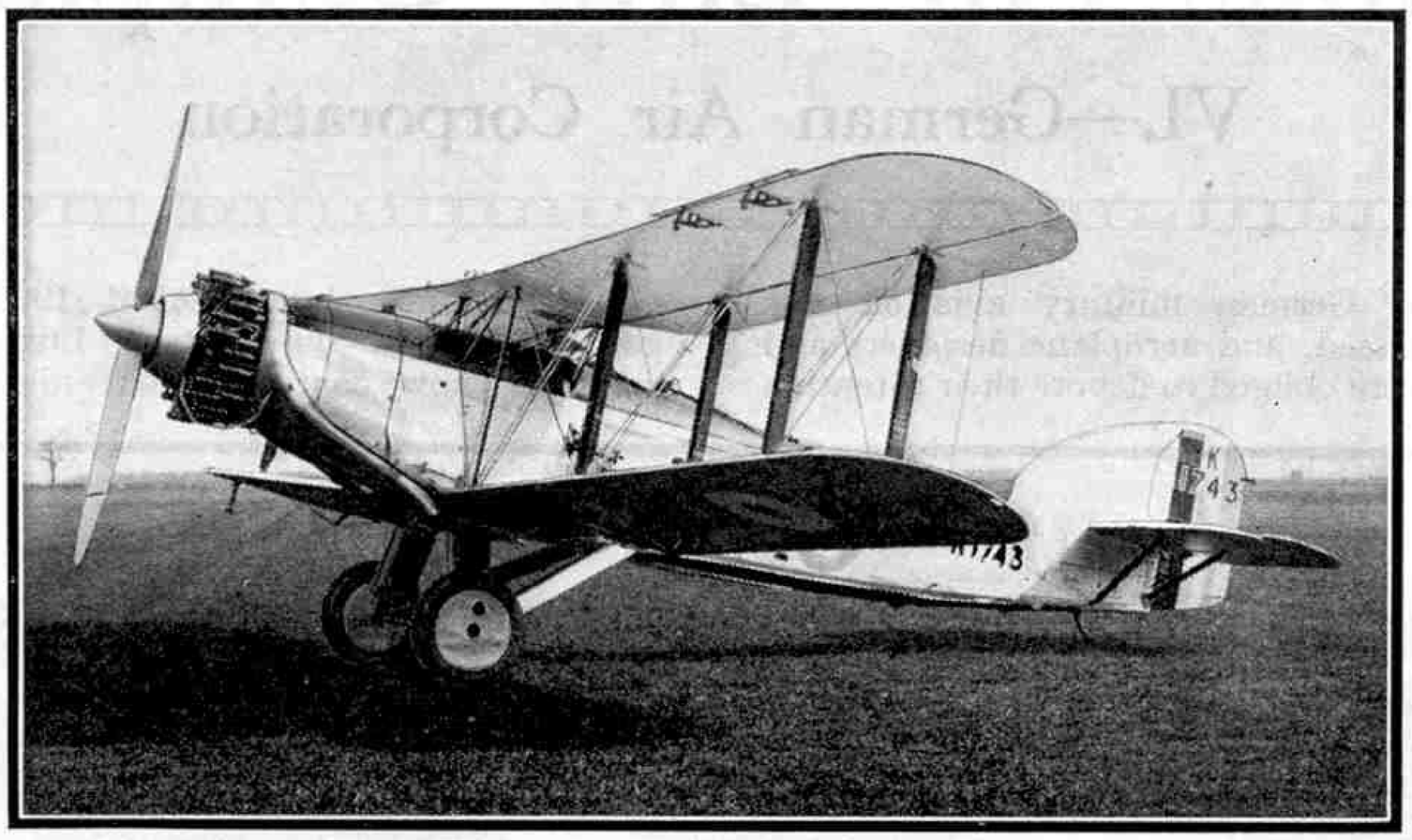
Seaplane for Transatlantic Service

Tests have been carried out in France on a new Blériot seaplane designed specially for the operation of an air service across the South Atlantic Ocean. The machine is provided with four engines that develop 3,000 h.p. and has an estimated cruising range of 2,200 miles and a speed of 140 m.p.h. It will be manned by a crew of five and will carry some 1,320 lb. of cargo. An interesting feature is that the engines are arranged so that they are easily accessible for repairs while the machine is in flight.

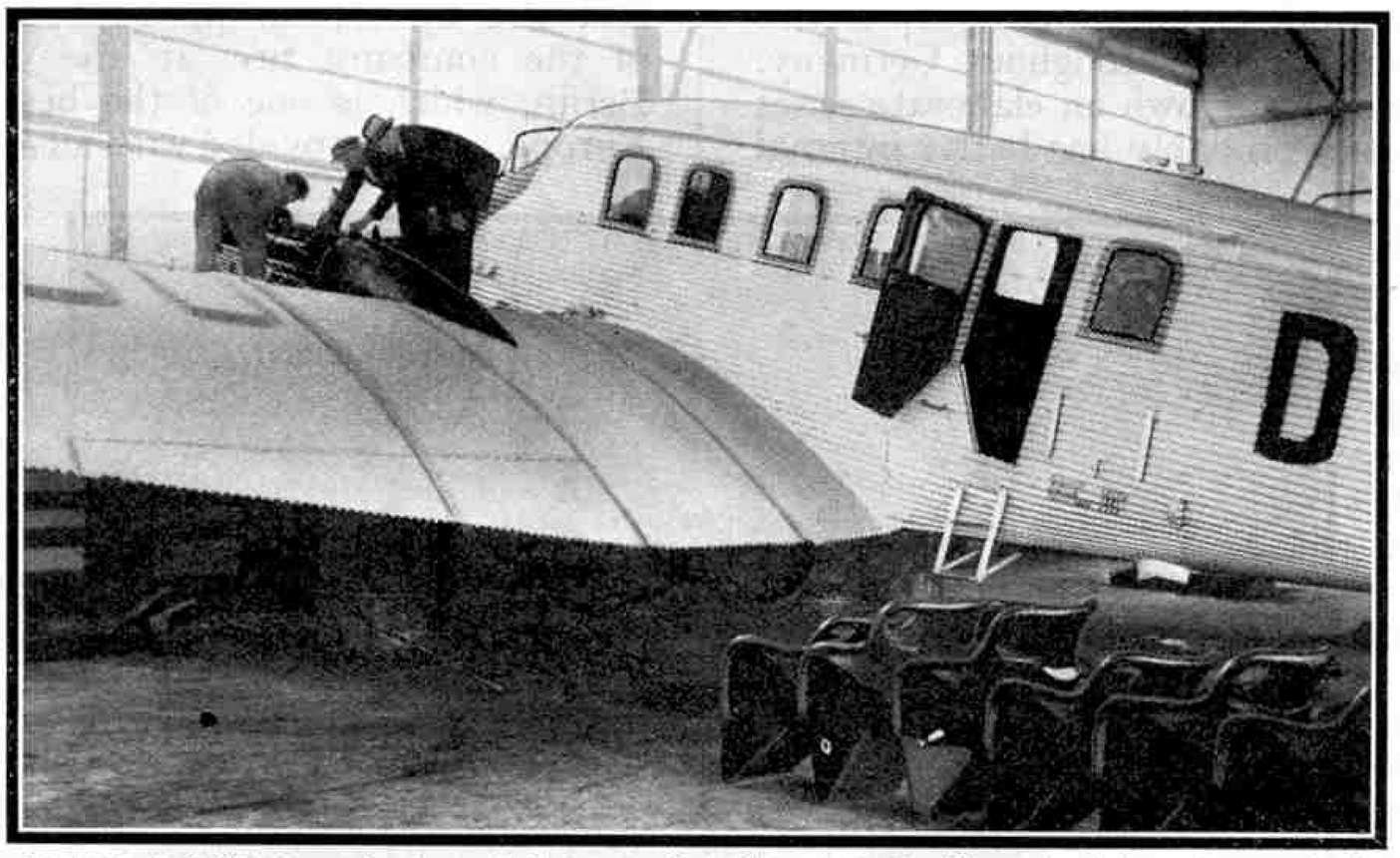
The Lowe-Wylde "Planette"

A production model of the "Planette," designed by the late Mr. C. H. Lowe-Wylde, has now been built. The machine, which was produced to give more economical flying than can be obtained with an ordinary light aeroplane, is, like its predecessor, a single-seater and is constructed wholly of wood. The performance is much better than that of the old type, and it is estimated that an altitude of 4,500 ft. can be reached in about 25 min. The machine will leave the ground in 50 yds. when there is a reasonable wind blowing.

The engine is mounted on a plywood "turret" or nacelle above the wing, and drives a pusher propeller. To start up, a few turns of a stranded steel cable are wrapped round a small drum on the propeller shaft, and the cable is then given a sharp pull. It is usual to stand in front of the aeroplane when doing this, so that if the throttle is left open by mistake it is possible to reach the lever and pull it back before the machine can get away.



The Fairey "Gordon" two-seater day bomber. For permission to publish this photograph, we are indebted to the Fairey Aviation Co. Ltd.



Deutsche Luft Hansa mechanics replacing an engine after overhaul. The seats that can be seen in the hangar were taken out of the aeroplane in order to enable the cabin to be thoroughly cleaned, while the engines were being attended to. This photograph is reproduced by courtesy of the Hansa Luftbild, G.m.b.H.

New Light Aero Engine

A new light aero engine, known as the Douglas "Dryad," has been produced in this country for service in small aeroplanes. It develops 40 h.p., and has a power weight ratio of 2.7 lb. per horse power. It is a flat twin-cylinder engine with a bore and stroke of 92 mm. and a capacity of approximately 1,200 c.c., the normal rating of 40 b.h.p. being developed at 4,000 r.p.m., and the maximum power of 52 b.h.p., at 4,500 r.p.m. The engine is provided with a complete dual ignition system and one magneto has an impulse starter, while the valves are of the overhead camshaft type and the complete weight of the machine is 110 lb. Flying trials are being carried out, although the engine has not yet passed the Air Ministry type test. We hope to publish photographs in a future issue.

Unsubsidised Channel Service

An unsubsidised air service between England and France has been operated for some time from Romford aerodrome. Two services daily in each direction are provided, the single fare being £3 10s. 0d. and the return fare £6 10s. 0d., while a special week-end ticket for £4 15s. 0d. is also available. The service is operated by D.H. "Dragons," all of which are fitted with wireless apparatus that enables them to maintain communication with ground stations while in the air.

Flight over the Antarctic Regions

This year an attempt is to be made by Sir Hubert Wilkins, the Polar explorer, who recently attempted to reach the North Pole in a submarine, to fly over the Antarctic Continent from the Ross Sea to the Weddell Sea. The return flight will cover about 3,000 miles, and it is hoped that this will be made non-stop. An American Northrop monoplane has been selected for the attempt. Sir Hubert intends to undertake a submarine expedition to the South Pole on his return from the flight.

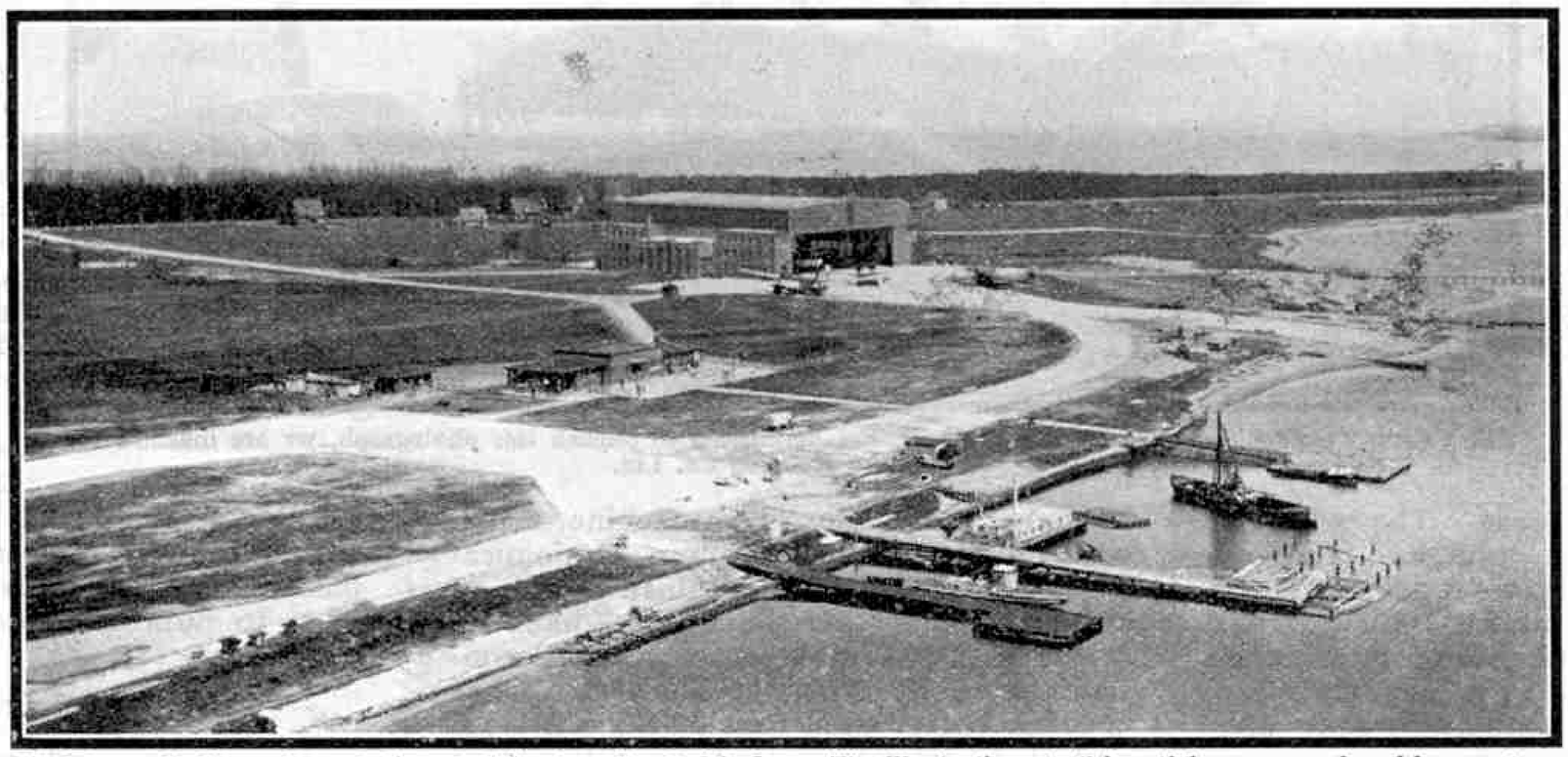
Russian Air Lines

Air lines between Kharkov and Rostov-on-Don and Kharkov and Odessa are now in regular operation in Russia, in addition to a new passenger line connecting Moscow with Mineralnie Vodi in the North Caucasus.

Famous Air Line Companies

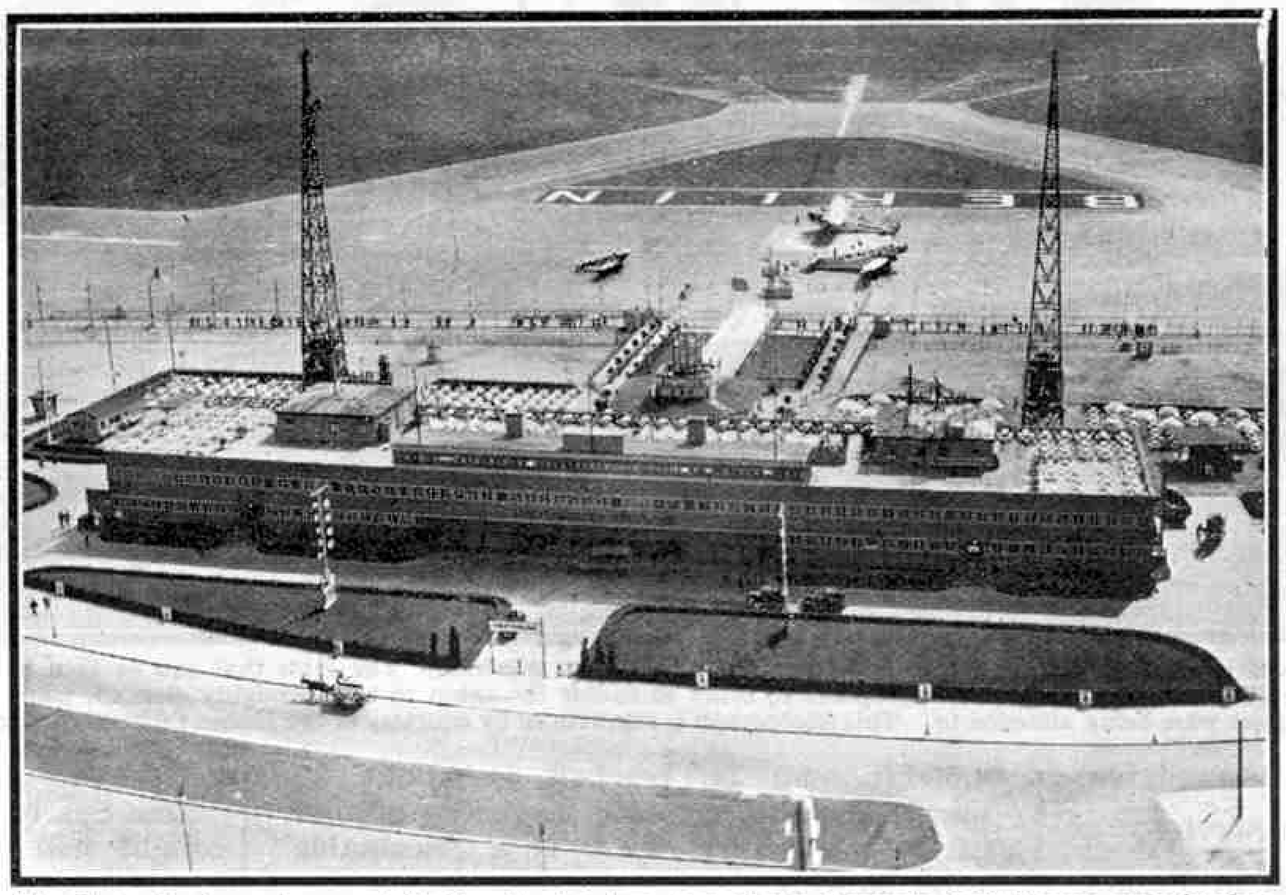
VI.—German Air Corporation

AFTER the War German military aviation was entirely suppressed, and aeroplane designers and constructors were obliged to devote their attention solely to machines for commercial purposes. The natural result of this concentration on civil machines has been to bring about a very rapid development both in design and construction. The first regular air traffic flights were inaugurated in 1919, and by the following year there was evolved a network of lines linking up Berlin with the most important towns throughout Germany. From this small beginning has grown an elaborate series of lines, and now Germany probably has better internal air services than any country in the world, not excluding the United States.



The Travemünde seaplane station at Lübeck on the Baltic Sea. The illustrations to this article are reproduced by courtesy of Hansa Luftbild, G.m.b.H., of Berlin.

Soon after the German internal air services had been thoroughly established, the directors of the air line companies began to turn their attention to external communication. The services were slowly but steadily extended to other countries, and by 1925 London, Copenhagen, Stockholm, Gothenberg, Helsingfors, Moscow, Vienna, Budapest, Zurich and Geneva were joined by air to Germany. The junction points in Germany for these services were Berlin and Munich, from where connections could be made to about a dozen of the largest German towns. It is interesting to note that some of these regular air lines were operated at night, the most important being those between Berlin and Copenhagen and Berlin and Stockholm. Passengers were not carried on these night flights, which dealt only with mails.



The Tempelhof aerodrome at Berlin, the headquarters of the Deutsche Luft Hansa organisation.

The majority of these services were operated by two large companies, but in April, 1926, they were amalgamated to form the Deutsche Luft Hansa, A.G. This company now controls about nine-tenths of the air traffic enterprise in Germany. The only other air transport firm in the country is a much smaller organisation, and is concerned with the operation of feeder lines in south and central Germany.

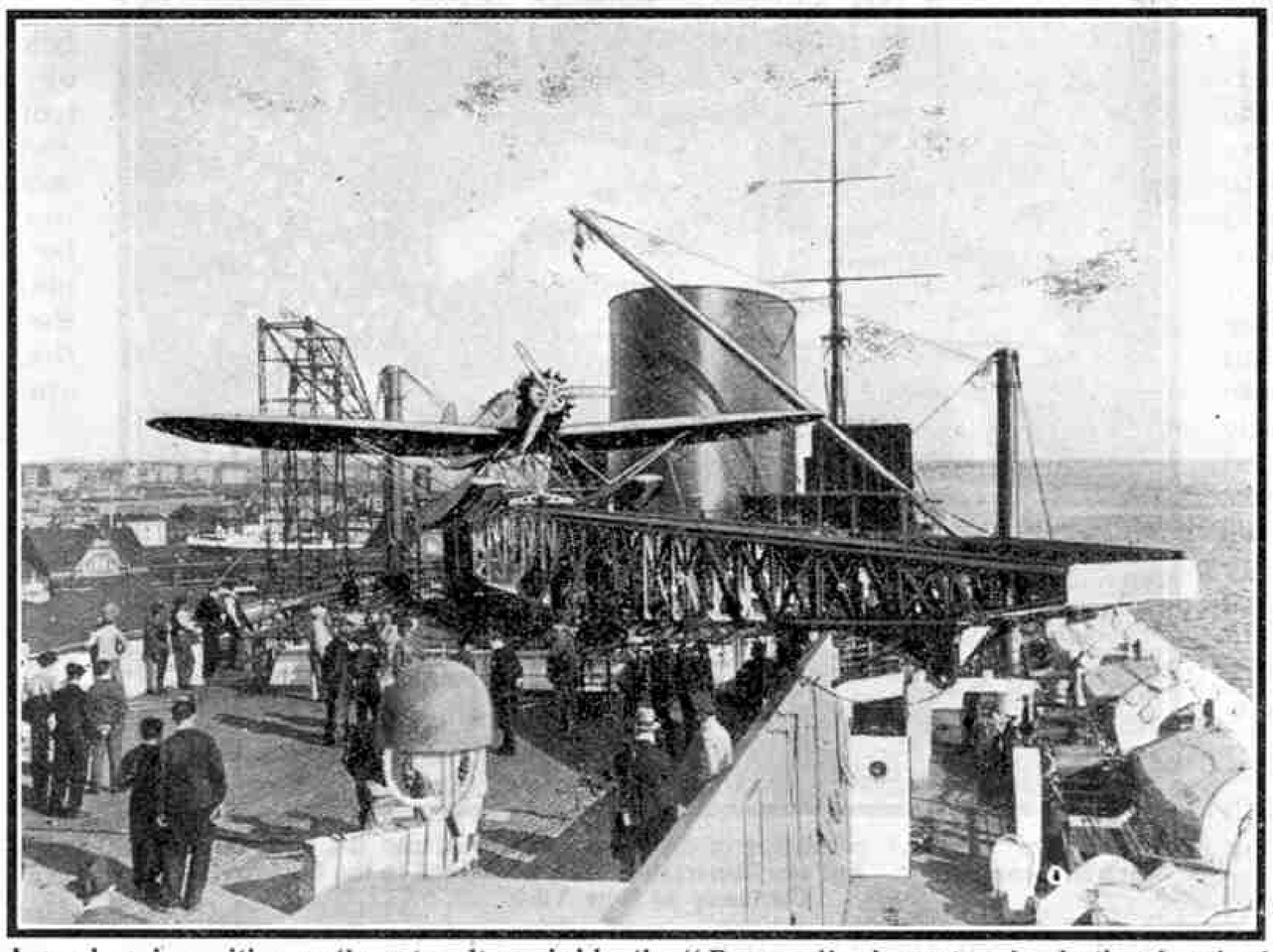
The Luft Hansa is supported by the Government and also by various public bodies. The headquarters of the company are at the Tempelhof Aerodrome, Berlin, which is one of the best organised airports in Europe. It is provided with an extensive and up-to-date block of administration buildings, including a large hotel-restaurant and every convenience for air passengers. Actually the accommodation provided is never all required for travellers by air, but it was decided to construct the buildings on such a scale that large crowds could be catered for when air displays were organised at the aerodrome.

When the company first came into being, 45 lines were regularly operated all the year round, either solely by Luft Hansa machines or in co-operation with foreign companies. In the summer additional services were introduced, bringing the number up to 54, which served 15 foreign and 57 inland airports. The company operated a night mail service between Berlin and Hamburg, and for the first time passengers were carried by night between Berlin and Königsberg, the first section of the Berlin-Moscow route. This night service left Berlin at 2 o'clock in the morning, and made it possible for passengers who left

London on the 8 a.m. aeroplane to reach Moscow in about 30 hours, allowing a fairly long stop for dinner at Berlin. This service is still in operation, but has been considerably speeded up. The Luft Hansa Company now operate about 60 services on which more than 80,000 passengers are carried every year, the figure for 1931, the latest year for which information is available, being 82,998. In addition, 20,908 passengers were carried in circular and special charter flights.

Passengers emplaning in a Junkers G.24, used on many of the services of the Luft Hansa.

One of the most important features of the work of the Luft Hansa has been the operation of catapult mail services between Atlantic liners and the shore. Mails are carried to Cherbourg by air to be put on board liners bound for the United States, and on both outward and homeward journeys the mails are taken by seaplane that is catapulted from the deck of the liner while still some distance out at sea. The two German liners making use of this service are the "*Europa*" and the "*Bremen*." The "*Europa*" carries a Junkers W.34 seaplane fitted with a Pratt and Whitney "Hornet" engine, which has a maximum speed of about 123.5 m.p.h. and is catapulted from the "*Europa*" when the vessel is about 600 miles from land. Mails from America are usually carried by air from the vessel to Southampton, and then on to Croydon, to be taken to Cologne, Hanover and Berlin by means of the normal air mail services, thus saving about 48 hours in the time of transit between America and Berlin. The saving on the outward journey is between 24 hours and 36 hours.


A seaplane in position on the catapult carried by the "Bremen." A great saving in time is gained by sending mails on by aeroplane when the ship is still many miles out at sea.

The seaplane used on the "*Bremen*" is a Heinkel H.E.58. This has a maximum speed of about 127 m.p.h. and is equipped with a 500 h.p. Pratt and Whitney "Hornet" engine. The machine was specially designed for this type of work.

An even more interesting Atlantic service, but across the South Atlantic Ocean, is shortly to be inaugurated. The service will be between Berlin and Buenos Aires, and will be operated on a five-day basis once every fortnight. It will be carried out on somewhat similar lines to the Imperial Airways Empire air services, sections being flown by different types of machines. Mails and passengers will be carried the 1,560 miles from Berlin to Cadiz, for instance, in fast landplanes. The crossing of the South Atlantic, however, will be carried out on an entirely new plan, for the machines in which the journey will be made will be refuelled half-way across from a 5,000-ton liner, the "*Westfalen*," that has been specially converted for the purpose.

The "*Westfalen*" is provided with a canvas apron similar to the Kiwull "*Watersail*" that was illustrated and described on page 200 of the "*M.M.*" for March, 1930. This apron consists of a sheet of canvas braced by cross pieces of wood on the underside, and terminating in a length of wire netting. It is strung from the stern of the vessel in such a manner that the wire netting is immersed in the water. The flying boat or seaplane will taxi on to the end of the apron and will then be lifted by crane into the ship. After the petrol and oil tanks have been replenished, the machine will be launched by means of a catapult, but if necessary it could slide down the apron and take off in the normal manner. The machine will alight at Pernambuco, where the mails will be transferred from it to a machine operated by the Condor Syndicate, a subsidiary Company of the Deutsche Luft Hansa. This machine will take forward the mails to Rio, some 1,200 miles away and then on to Buenos Aires, 1,300 miles from Rio, and about 7,700 miles from Berlin.

A fortnightly service to South America is also to be operated by the "*Graf Zeppelin*" this year. It is hoped that the inaugural flight will be made some time next month, but details are not yet available. An airship base is being built at Seville in Spain. This will be used not only for the service between Europe and South America, but also for one between Europe and North America. This route has been chosen because the crossing over the North

(*Continued on page 553*)

Of General Interest

A Vacuum Tube "Organ"

An interesting vacuum tube miniature "organ" has been produced by the engineers of the International General Electric Company, Schenectady, New York, with the object of demonstrating the versatility of the Thyratron tube.

One of the peculiar characteristics of this tube is that, with direct-current input, alternating-current output through a wide range of frequency can be obtained, according to the capacitance and resistance used in the circuit. In the toy "organ" eight Thyratron tubes are made to produce eight different alternating-current frequencies, related to each other as are the notes in the octave of the major scale in music. Fixed capacitance is used, and the different notes are obtained by means of different resistances, rheostat knobs in each tube circuit making it possible to keep the notes accurately in tune. The eight notes are controlled by a miniature piano keyboard. The semitones could be included, and further octaves added, by incorporating an additional tube circuit for each additional note.

Each Thyratron tube is operated continuously while the "organ" is in use, and therefore the equipment is quick enough to respond to any rapidity of notes that the keys permit. A connection is made from the plate or output circuit of each tube to the keyboard of the toy piano. When the keys are depressed they close contacts, so that either single notes or chords may be obtained from the loud speaker in series with the keys. Both the volume and the tone may be varied by controls placed on the top of the piano. Across the loud speaker there are a potentiometer and a variable capacitance. The potentiometer is used for volume control, and the variable capacitance for tone control, both wood-wind and brass effects being available. As the controls are incorporated in the piano, it is possible to use the "organ" at a distance from the Thyratron tube units, through a length of cable.

A miniature "organ," consisting of eight vacuum tubes, and the keyboard from which it is controlled. For our illustration we are indebted to the General Electric Company of New York.

"Organs" using the ordinary high-vacuum tubes have been built previously, but the use of the Thyratron tube, a cathode mercury-vapour device, is new. The richness of the harmonics and overtones is particularly noticeable with this tube; less amplification is needed than with ordinary high-vacuum tubes, and smaller tubes may be employed. In this "organ" the tubes are only 1 in. in diameter and less than 4 in. in height.

* * * * *

The deepest part of the Atlantic Ocean is a depression known as Nares Deep, north of Porto Rico, in the West Indies, and there a record ocean depth of 44,000 ft., or nearly nine miles, has recently been discovered. The greatest depth previously known was in the Pacific Ocean off the coast of Japan, where a gigantic submarine ditch 34,416 ft. in depth was discovered several years ago.

Dark and Frozen Worlds

On page 466 of the *"M.M."* for June, 1931, we described a thermocouple, or electrical thermometer, devised for the purpose of measuring the temperature of the stars.

With the aid of this remarkable instrument it has been found that certain blue stars have surface temperatures as high as 23,000°C. The planets of our Solar System are nothing like as hot as this. Mercury, the one nearest the Sun, has a maximum surface temperature of 437°C, or more than four times that of boiling water, and the other plants are much cooler. Venus is surrounded by clouds, and measurement of the heat radiated from this planet tells us nothing about the surface temperature, but it is interesting to find that the night temperature at the height to which the clouds reach is about 23°C below freezing point.

Mars shows great variations, but generally speaking the temperatures on this planet are similar to those on the earth. The outer planets are very cold. For instance, the temperature of the surface of Jupiter is 138°C. below zero. The temperatures of the planets farther removed from the Sun are even lower, and that of Pluto, the most recently discovered member of the Sun's family, is believed to be as low as—210°C! As these planets are a long way from the Sun, very little light reaches them, and they are indeed dark and frozen worlds.

Danger Warnings by Gramophone

When the miners at the Wyndham Colliery in South Wales are about to descend the pits a stentorian voice warns them of the chief points of danger in underground workings. A bell tolls and a voice then says: "Hullo! Manager Calling! Safety First. Search your pockets for matches, etc., before you go down the pit. Don't carry tools and blocks of timber in the cage with you. Take care of your safety lamps; hang them up in a safe position. Don't walk the engine plane when the ropes are in motion. Don't go in front of trams where the gradient is over 3 in. per yard. You must not work under overhanging coal or ground unless securely spragged. Hauliers, take care of the horses under your charge, don't abuse them, treat them kindly, take your horses safely to the stables at the end of the shift. Cases of ill-treatment will be severely dealt with."

The voice comes from a gramophone and it is believed that the novel device, the idea of the manager of the mine, will be responsible for reducing the number of accidents in collieries. Special "His Master's Voice" records are played through loud-speakers situated at the pithead whenever a party of men go on duty, and it is found that the warnings make a stronger appeal through the ear than through the eye. The records are changed from day to day in order that they may not become too familiar.

A Rival to Beet in the Sugar Industry

The Jerusalem artichoke has long been regarded by many gardeners as a weed because of the speed with which it spreads. It has now suddenly acquired greater importance from the discovery that it is capable of producing more sugar to the acre than beet or any other sugar-producing plant, with the exception of cane sugar itself. A small experimental mill has already been established in America for the extraction of the sugar. In it the artichokes are washed, sliced and dried, and the extraction is completed by means of hot water and evaporation of the syrup in vacuum pans.

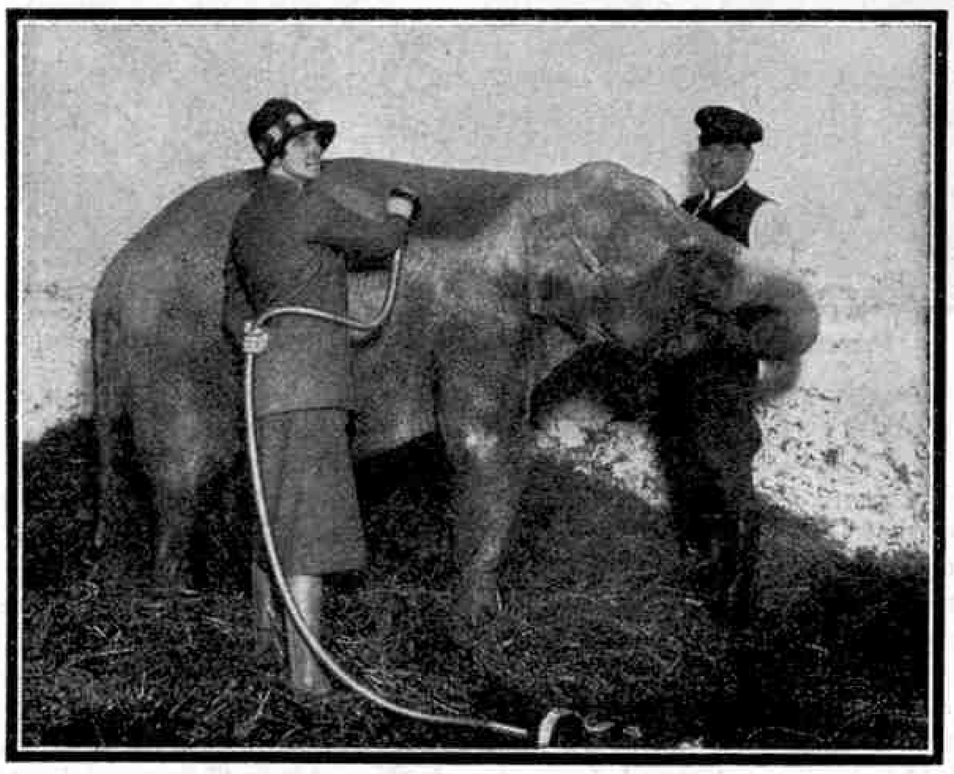
The sugar obtained from the Jerusalem artichoke differs from that contained in beet and the sugar cane and is known as levulose. It is more readily digestible than ordinary sugar, and thus is of particular value for infant feeding and also to invalids, especially those suffering from diabetes, to whom ordinary sugar is forbidden. Its great superiority in this respect over cane sugar may lead to the gradual displacement of beet in this country and in central Europe by the Jerusalem artichoke.

A boiler being carried by water to its destination in Assam, India. We are indebted to Marshall, Sons & Co. Ltd., Gainsborough, for this interesting example of transport methods overseas.

Nile Perch Six Feet in Length

An interesting experiment may shortly be tried in Lake Nabugabo, a sheet of water about 12 square miles in extent that is situated near the northern shore of Lake Victoria in Central Africa. It is proposed to introduce into it the great Nile perch, a voracious fish that may attain a length of 6 ft. This is easily caught and is excellent eating.

The purpose of the experiment is to test the suitability of the Nile perch for introduction into Lake Victoria. There are abundant supplies of small fish in the centre of the lake and these will form suitable food for the perch, but unfortunately there is a danger that the giant fish also will prey on the ngege, a species of carp that haunts the shallows and is a valuable source of food to the natives. The perch to be introduced into Lake Nabugabo therefore are on trial. If they feed on the ngege they will not be taken to Lake Victoria, for the loss that would follow would be greater than the gain.



A novel renovation ! An elephant at the Bristol Zoo undergoing a thorough grooming by means of an "Electrolux" vacuum cleaner. Photograph by courtesy of Electrolux Ltd.

It is very important to know exactly the consequences of any step that may disturb the balance of nature, for large-scale experiments cannot be stopped easily. The introduction of the rabbit into Australia is an example of the evil consequences that may follow such an experiment. There this creature has few natural enemies, and it has multiplied to such an extent that it has become a pest instead of a convenient source of food, as those who first liberated it expected. Similarly the Nile perch may become a scourge to other valuable fish in Lake Victoria, and it must prove itself to be of good character before it can be allowed to take up residence in the waters of that famous Lake.

Strains Caused by Electric Currents

Few people realise that conductors carrying heavy electric currents are subject to great strains. In an experiment made in America, an alternating current of 20,000 amps. was passed through two cables 1½ in. in diameter, that were kept 2 in. apart, and had heavy rope 2 in. in circumference tied round them at intervals. When the current was passed through the cables they repelled each other so violently that they writhed like angry snakes, while the strain actually broke some of the lashings and caused others to bite deeply into the insulation.

The maximum force exerted on every foot of the cable used in this experiment was 10,000 lb. and the strain changed from zero to its greatest value 120 times in every second. Thus the cables were subject to a rapid succession of extremely violent blows. Needless to say, this exhibition of the tremendous mechanical force exerted by the passage of a powerful electric current through the cables was witnessed from a very respectful distance by those who planned the experiment.

Moving Millions of Tons of Air

Wireless announcements of weather forecasts have made us familiar with "deep depressions" over the Atlantic Ocean and elsewhere. Such depressions are regions of low pressure, the barometric heights at points within them being below the average. The lowering of the pressure may be only a fraction of an inch, but immense quantities of air must be transferred in order to cause it, for the change takes place over a very large area. One depression that overlay the North Atlantic a few years ago had a diameter of 3,260 miles, and it has been calculated that within it there was a shortage of air of no less than two million million tons.

An even more striking example of the immense amount of air moved in these atmospheric disturbances comes from Siberia. Every winter an immense anticyclone, or high pressure system, forms over Siberia, the air being dense and very low in temperature; and in 1907 the atmosphere in this region was nearly seven million million tons heavier than the average for all seasons. Possibly even this record was surpassed in February 1930, when cold air oozing westward over Europe caused a long and severe frost.

The chief agent in the movements of these immense masses of air is the Sun, for its rays provide the heat that stirs atmospheric currents into activity. This is the cause of an annual transference of air between the two hemispheres in accordance with the changes of season. It is probable that in January, the depth of the northern winter, the air above the northern hemisphere is about ten million million tons heavier than above the southern hemisphere, while in July the air above the southern hemisphere, then in its winter season, is the heavier by a similar amount.

The Story of Prince Lee Boo

Sequel to the Wreck of an East Indiaman

By A. Hartley

FEW of the people who pass through the old churchyard at Rotherhithe know the interesting story of a foreign prince who is buried there; nor do many of the visitors to the church at Colyton, Devon, who pause to read the tablet "In Memory of Captain Henry Wilson of the Honourable East India Company," guess his romantic part in that story.

The beginning of the narrative takes us back to the days when the sailing ship was at the height of its glory, and the fine merchant vessels of the Honourable East India Company were a familiar sight on the trade routes of the southern seas. On 20th July, 1783, the Company's sailing packet "*Antelope*," of about 300 tons and commanded by Captain Henry Wilson, left Macao, a Portuguese city at the mouth of the Canton River, China, on a trading voyage in the East. Only a few hours out from port the ship encountered bad weather that continued day after day. On 9th August there was a lull in the storm, but shortly after midnight conditions rapidly became worse. The wind freshened, the sky became overcast, and torrential rain fell to the accompaniment of thunder and lightning. Suddenly the lookout man yelled "Breakers!" and the warning had scarcely reached the officer on deck before the ship struck.

Mr. G. Keate, in his quaintly-worded book on the Pelew Islands, compiled from Captain Wilson's records, says of the wreck of the "*Antelope*": "The horror and dismay this unhappy event threw everybody into was dreadful; the Captain and all those who were below in their beds sprang upon deck in an instant anxious to know the cause of this sudden shock to the ship, and the confusion above; a moment convinced them of their dreadful situation; the breakers alongside through which the rocks made their appearance presented the most dreadful scene and left no room for doubt. The ship taking a heel, in less than an hour filled with water as high as the lower deck hatchways. During this tremendous interval the people thronged round the Captain and earnestly requested to be directed what to do, beseaching him to give orders and they would immediately execute them."

Prince Lee Boo, the subject of this article, in European dress.

Eventually the boats were lowered, and a compass, provisions, water, some small arms and a supply of ammunition were placed in each boat before the crew embarked. Shortly afterwards daybreak disclosed a small island about three or four leagues distant, and on this the shipwrecked mariners landed safely. Nothing was found in the vicinity of their landing place to suggest that the island was inhabited, and the men's fear of being suddenly assailed by hostile savages lessened as the day passed without any untoward incident. The ship still held together, and some of the boats returned for further stores.

The fear of cannibals was revived the next morning when two canoes each containing several natives appeared and drew near to the island. Captain Wilson, accompanied by a member of his crew able to speak the Malay language, went out to meet them and friendly relations were established. The shipwrecked men were the first white people the natives had ever seen and were objects of great interest to them. The natives told the Captain that he had landed on Oroolong, one of the Pelew Islands, which were governed by King Abba Thulle who lived on Pelew Island. The natives then left for Pelew to inform the King of the shipwreck, and later he visited the white men's camp, accompanied by a retinue of about 300 of his subjects. The King did not wear any ornaments of distinction, but carried a hatchet on his shoulder. The handle of this implement was of iron, shaped like the letter "L," and the hatchet did not require any steadying when the bearer was walking.

The King and his people were most hospitable, and full of curiosity. The Englishmen's white skins, their clothes—the natives were quite naked—and the numerous goods and chattels they had brought from the ship created endless commotion. The appearance on the scene of a large Newfoundland dog that the Captain had brought ashore with him created a tremendous sensation, for there were no quadrupeds on the islands.

The ship had been badly holed and gradually broke up, but sufficient tools and material were retrieved to enable the crew to build a new ship on the shore of the island. The work took many weeks, and during the time it was in progress the King visited Oroolong many times to study the manner in which it was being done. He was greatly impressed by everything he saw the Englishmen do, and mentioned that when the vessel departed he would send some of his people on it to England. Eventually the ship, complete with sails and with provisions from the island on board, was ready to depart, and the Captain informed the King that he would sail on the following day. The King then confided that, though his subjects respected him and regarded him as superior in rank and knowledge, yet, after being with the English and seeing the lowest man under the Captain's command exercise talents entirely new to him, he had often felt his own insignificance. He had resolved therefore to entrust his second son, Prince Lee Boo, to the Captain's care, that he might accompany the English and be instructed in European ways, so that when he returned he could greatly benefit his own country. The King assured the Captain that his son was a young man of amiable and gentle disposition, and of a mild temper. He said that he had sent for him from a distant island where he had been under the care of an old man, and that he was then at Pelew taking leave of his friends and would be with the Captain the next morning.

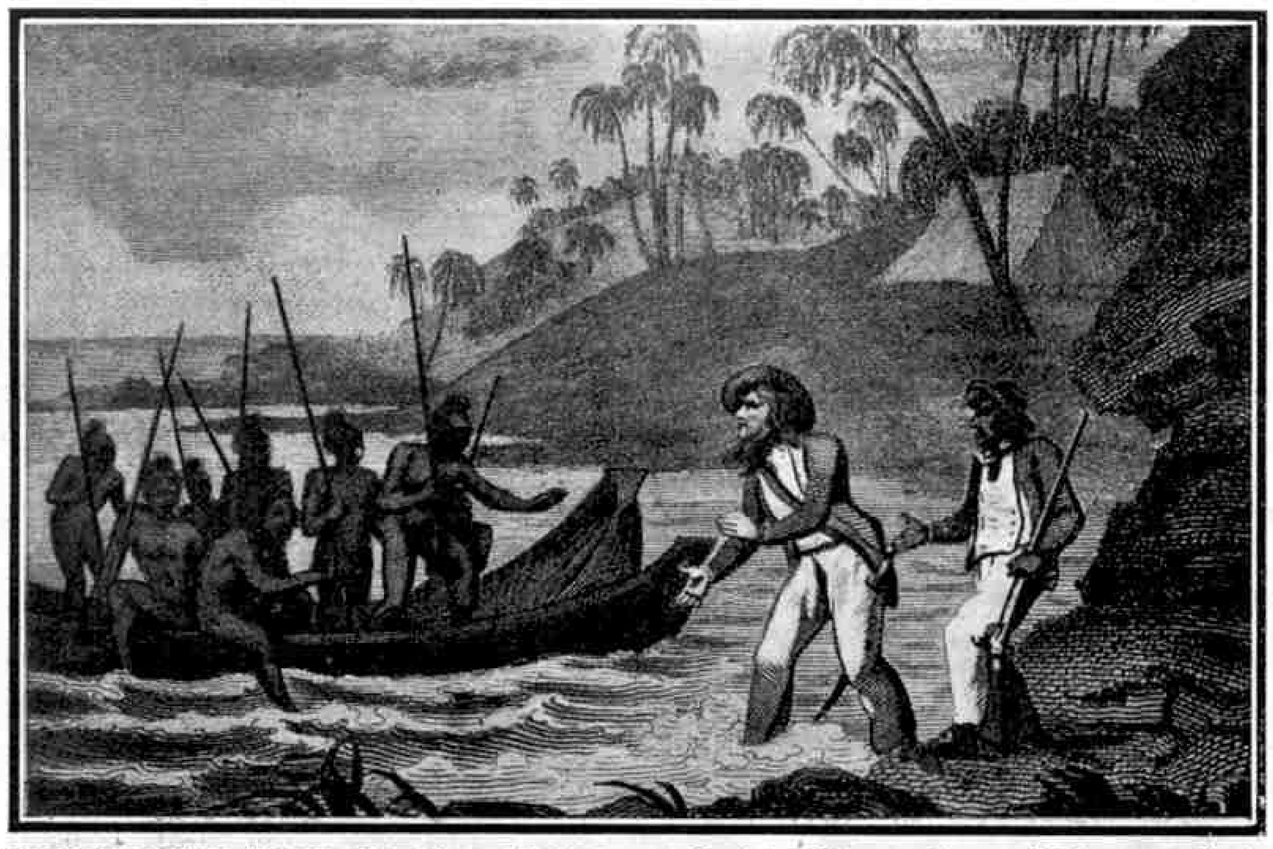
Captain Wilson replied that he was greatly honoured by this singular mark of the King's confidence and esteem, and that he would treat Lee Boo as his own son.

The new ship, which was named the "*Oroolong*," sailed from the island for Macao on 12th November, 1783. The motion of the ship at first made the Prince seasick and obliged him frequently to lie down. He soon got over this, however, and on the fourth day of the voyage he was able to eat a flying fish that was caught upon the deck. After this meal he told his attendant that "he was sensible that his father and family had been very unhappy from knowing that he had been sick." The Captain gave him a shirt, a waistcoat and a pair of trousers, and although at first he used the shirt and waistcoat only as a pillow, he became reconciled to wearing them as the ship reached a cooler climate.

As the ship approached Macao, Lee Boo was delighted at the numerous Chinese fishing boats and junks. Some large Portuguese ships at anchor astonished him greatly, and he exclaimed: "Clow, clow, muc clow!" that is, "Large, large, very large!" As the "*Oroolong*" anchored close to the island Chinese boats crowded round the ship. Many of them contained poor Tartar women who, with their children tied to their backs, begged for fragments of food, and the Prince generously responded to their appeal. At Macao the Captain and Lee Boo became the guests of a gentleman named

McIntyre and were taken to his house for supper. This was the first time that the Prince had ever seen a house, and in silent admiration he examined the upright walls and the flat ceilings. At the house Lee Boo made his first acquaintance with European ladies and was not at all embarrassed. He permitted them to examine his tattooed hands, seeming pleased with the interest shown. The vessels of glass used at supper greatly interested him, but what most attracted his attention was a large mirror at one end of the room. He stood in perfect amazement at seeing himself; he laughed, drew back, and returned to look again, absorbed in wonder. He made an effort to look behind the glass, but found it fixed close to the wall. Mr. McIntyre understood the idea that had occurred to the Prince and ordered a small glass to be brought. Lee Boo looked at his face in this, and then looked behind the glass to discover who looked at him. He was quite unable to make out how all this was produced.

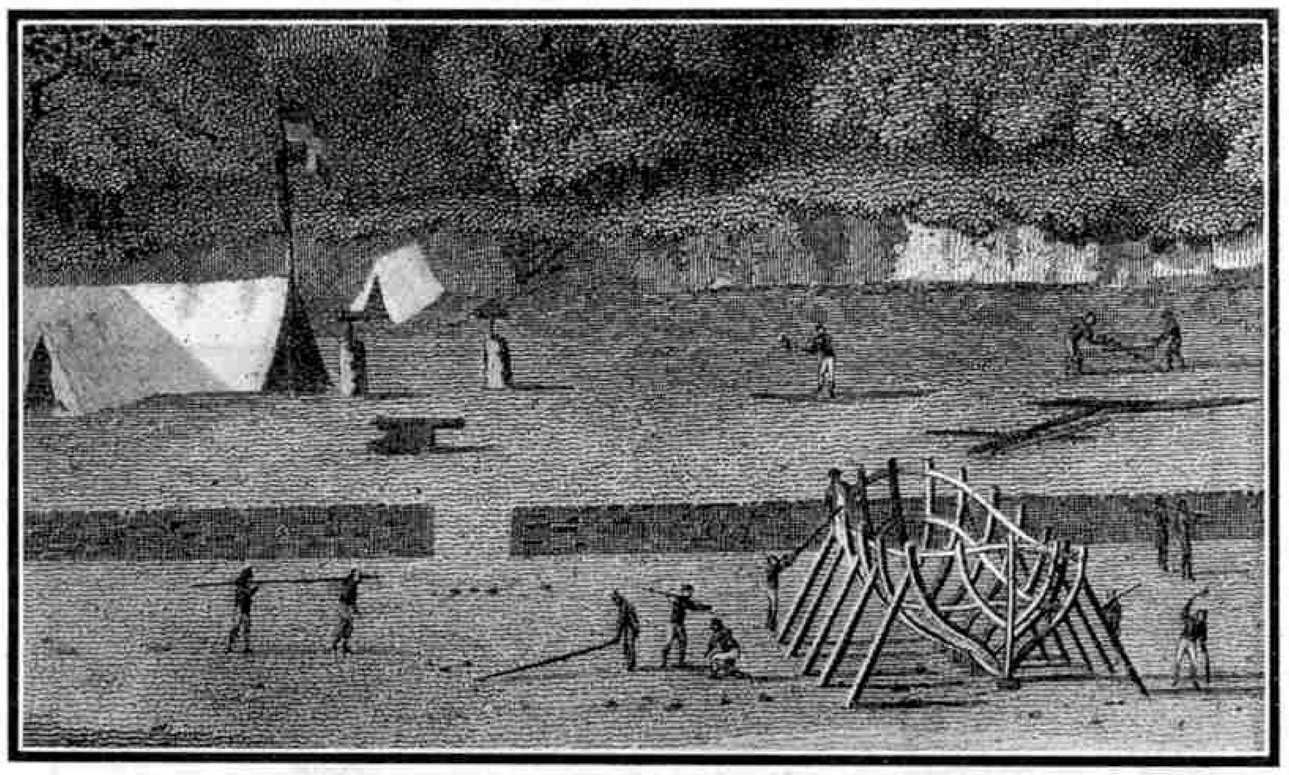
Thinking their novelty would please him, the members of Mr. McIntyre's family gave him other presents, including a long string of glass beads, the sight of which delighted him immensely. He seemed convinced that he had in his hands all the wealth of the Indies, and ran to Captain Wilson asking for a ship to be sent at once conveying the presents to his family at Pelew.



The Pelew natives discover the shipwrecked crew. Captain Wilson and one of his men able to speak the Malay language greeting the natives.

The sheep, goats and other cattle that Lee Boo saw while at Macao filled him with wonder. At home he had been very friendly with "Sailor," the Captain's dog, and on seeing a horse for the first time at Macao he at once called it "Great Sailor."

From Macao the Captain, Lee Boo and others sailed northward to Canton, where they embarked for England on the Company's sailing ship "*Morse*." During the voyage the young Prince associated only with the officers of the ship, and he received much attention and kindness from them. His desire for knowledge was insatiable. He wanted to know the name and nationality of every ship they passed, and would repeat what he was told over and over again until he had fixed it in his memory. He obtained a long line and made a knot in it every time an enquiry for information was gratified. Soon the knots became so numerous that he was obliged to go over them each day to refresh his memory, and often had to consult Captain Wilson or the ship's officers because he could not remember to what some particular knot referred. When the officers saw him busy with his line they used to say that he was "reading his journal." He had not been long on the voyage before he requested the Captain to get him a book and point out to him the different letters, so that when he knew them he could learn to read.



The crew building a ship in which to sail back to England.

The ship called at St. Helena and Lee Boo accompanied the Captain ashore. On being shown a school he expressed a wish that he might learn in a similar way. He was much impressed by the soldiers and by the cannons on the fortifications.

As the "*Morse*" approached the English Channel the number of ships that could be seen pursuing their different courses increased so much that Lee Boo was obliged to give up keeping his journal, but he continued to ask eagerly where the respective ships were going. The passengers of the "*Morse*" disembarked at the Isle of Wight and crossed to the mainland in a boat that arrived at Portsmouth on 14th July, 1784.

On arrival in England Lee Boo was taken to Captain Wilson's house at Rotherhithe, travelling by coach from Plymouth in the company of the Captain's brother. At Rotherhithe he was soon made to feel at home, and he greatly amused the family by his quaint account of his journey from Portsmouth. He told them that the journey had been very pleasant; "that he had been put into a little house, which was ran away with by horses; that he slept, but still was going on; and, whilst he went one way, the fields, houses and trees went another." On being shown his room at night he made his first acquaintance with a four-post bed. Greatly astonished at this imposing structure, he jumped in and out and pulled aside the curtains, finally settling down with the remark that "The English had houses for everything."

Lee Boo wore English clothes but continued to have his hair in the fashion of his own country. Captain Wilson introduced him to several of the directors of the Honourable East India Company, and took him with him on visits to many of his personal friends. It was not thought advisable to take the Prince to any places of public entertainment, lest in such crowded resorts he should accidently contract smallpox, a disease against which the Captain decided to inoculate him. Lee Boo accompanied the family to church on Sundays, and although he could not comprehend the service he appeared to understand perfectly the intent of it, and always behaved with remarkable propriety and attention. He was sent daily to an academy at Rotherhithe to learn to read and write and pursued his studies eagerly, gaining the esteem of his teacher and the affection of his school companions. He amused the Captain's family by his liveliness, and often entertained them by good-humouredly mimicking the different mannerisms of his school fellows. He declared that "when he returned to Pelew he would have a school of his own."

Captain Wilson took Lee Boo to witness Lunardi's first balloon ascent at London on 11th August, 1784. He was not much impressed by the spectacular event, however, and remarked that "it was a very foolish thing to ride in the air like a bird when a man could travel so much more pleasantly on horseback or in a coach."

The Prince was making excellent progress in his study of the English language when he was overtaken by the very disease that so much caution had been taken to protect him from, and on 16th December, 1784, he became very ill. A doctor was called in and he declared that there was no hope of Lee Boo recovering. Mr. Sharp, formerly surgeon of the "*Antelope*," and among those who had been shipwrecked, came to see him. The sick Prince recognised him and said that he was "sensible that Father and Mother much grieved, for they knew he was very sick." That night his condition grew worse, and grasping Mr. Sharp's hand he said earnestly: "Good friend, when you go back to Pelew tell Abba Thulle that Lee Boo take much drink to make smallpox go away, but he die; that Captain Wilson and Mother very kind—all English very good men—was much sorry he could not speak to the King the number of things English had got." Shortly afterward he passed away peacefully.

Captain Wilson notified the Honourable East India Company of the unfortunate death of the young Prince and received orders to conduct everything with decency and order. The Prince was buried in Rotherhithe Churchyard,

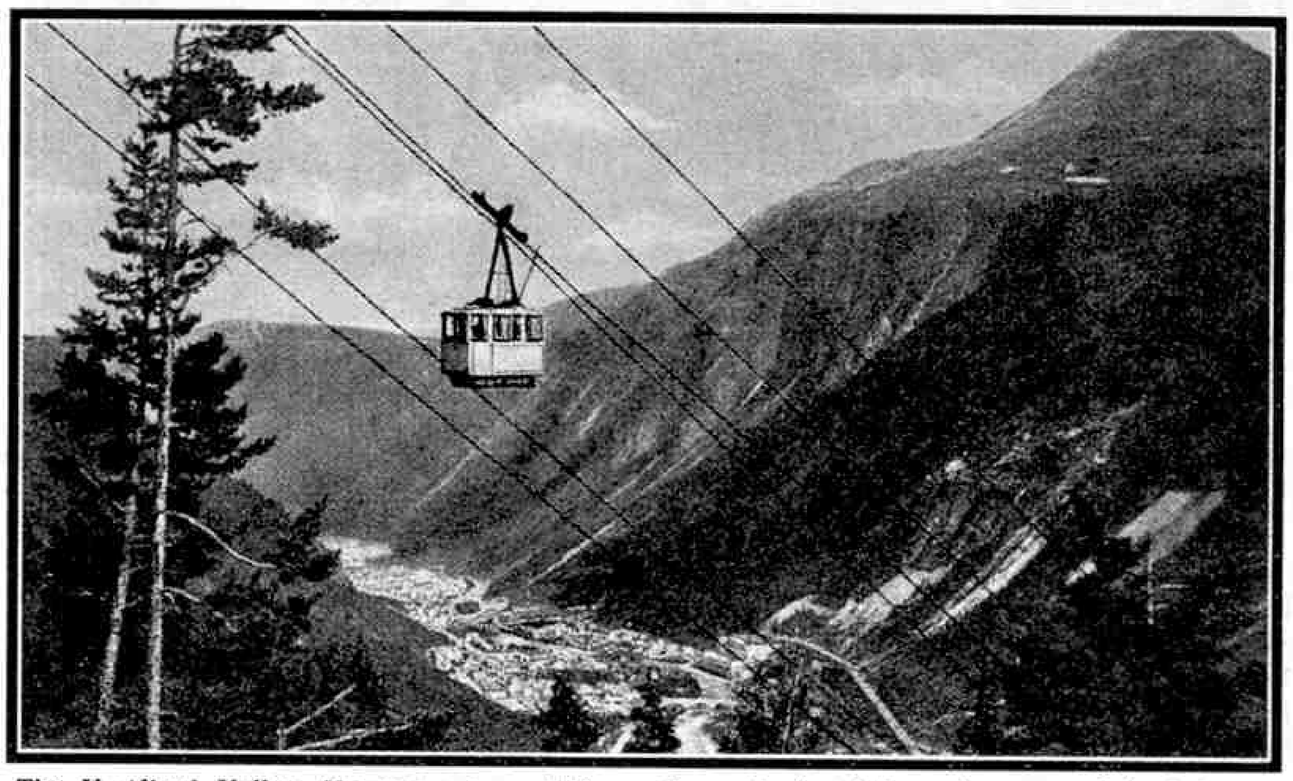
(*Continued on page 552*)

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Power Stations in a Sunless Valley

Last summer I stood on the top of Gausta Mountain in Norway, 6,000 ft. above sea level, and peered down into the Vestfjord Valley. There, 4,500 ft. below me, was Rjukan, a town of about 10,000 inhabitants that is famous for its hydro-electric power stations, once the greatest in the world. The water employed in the scheme comes from Lake Mösvatn, where a giant dam has been built to enable 30,000 million cu. ft. of water to be stored. Lower down the stream that issues from the lake is a smaller dam and from there the water flows through a giant tube with a cross sectional area of 279 sq. ft. to a reservoir above Rjukan, from which it is distributed to 10 turbines, each of 15,000 h.p.



The Vestfjord Valley, Norway, where "Norwegian saltpetre" is made, as explained in the accompanying article. The car of the aerial ropeway climbs 1,600 ft. in five minutes. Photograph reproduced by courtesy of Mr. Edv. Köhn, Rjukan.

On leaving the turbines the water flows to a second reservoir, from which it is carried by means of a pipe driven through more than three miles of solid rock to a power station at a lower level. There is a third power station near Lake Mösvatn, and the total electrical energy produced in the valley is nearly 500,000 h.p. This is devoted chiefly to the production of "Norwegian saltpetre," or calcium nitrate. For this purpose air is forced through a gigantic electric arc of very high temperature and the oxides of nitrogen formed in this are absorbed in milk of lime. This method was invented in 1903 by K. Birkeland and S. Eyde, two famous Norwegian chemists.

Vestfjord Valley is surrounded by mountains from 3,000 ft. to 6,000 ft. in height, and for five months of the year the rays of the Sun do not penetrate into its depths. In order to enable the inhabitants to enjoy sunshine, a ropeway has been built by means of which the mountain range may be ascended in five minutes. Wonderful views are obtained from the car of this aerial ropeway as it is hauled up from the depths of the valley.

The water that is now put to such excellent use once formed one of the most remarkable waterfalls in Norway. Only on rare occasions during the flood season is there sufficient surplus water to fill up the old bed of the stream, and this causes a great sensation when it plunges over the brink of the former fall.

R. N. TORGERSEN
(Oslo).

A Visit to Marrakesh

When in Casablanca a short time ago I joined a party making a railway journey to Marrakesh. The train started from the quay at Casablanca, stopping a few minutes after leaving in order to enable our steam locomotive to be changed for an electric one. I found on enquiry that the system was being electrified, but the track to the docks had not yet been dealt with.

The railway station at Casablanca, Morocco. Photograph by P. Thompson, London.

Our next stop was in the station at Casablanca and there a dark green electric locomotive took charge of our train and hauled it for the next 75 miles. A steam engine then replaced it, for we had reached the limit of electrification. Soon after making this change we ran into a horde of locusts and the train wheels crushed thousands of the insects on the rails, making these very slippery. The driver increased speed, for it would have been impossible to restart if the engine had stopped, and hundreds of dead insects killed by violent impact with the train could have been picked up on the platforms.

On arrival at our destination we entered motor cars and began our tour of the city and its neighbourhood. We were proceeding down a long wide road bordered

with palm trees when a tyre of our car blew out with a loud report. The driver spent 20 minutes in repairing it and during that time we saw many interesting Moroccan types. First came a water carrier shouting and ringing a bell to attract attention; then a man dressed in a dirty robe rode by on a donkey, followed by a second donkey that wandered slowly down the road with a huge packing case, surmounted by a table and two large baskets, strapped on its back.

At last we set off in pursuit of the rest of the party and arrived at the native market. We passed through a narrow opening and found ourselves in a very narrow lane of shops. Over the pathway there was a straw roof that was intended to keep out the burning rays of the Sun, but also had the effect of keeping in the smell of garlic and onions, which was very pronounced! Occasionally a heavily laden donkey bore down upon us, compelling us to flatten ourselves against the wall in order to enable it to get past.

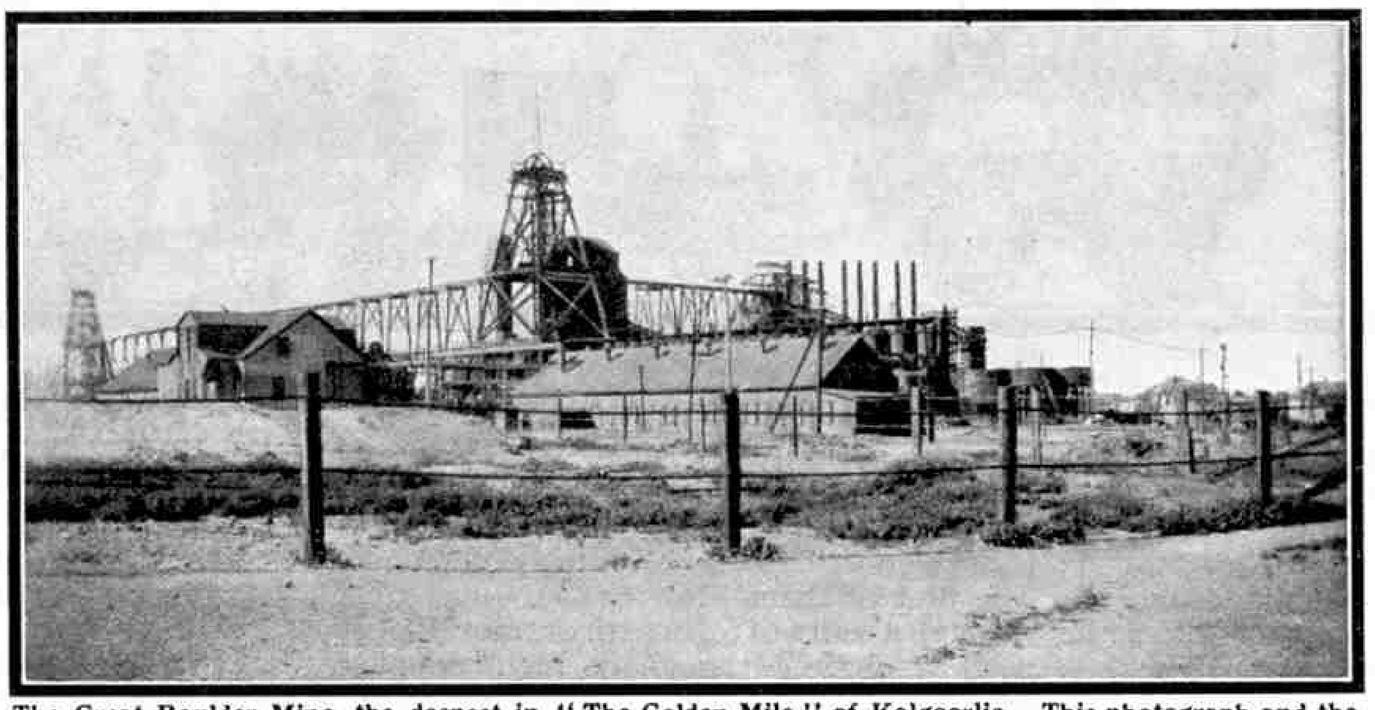
After visiting the Sultan's Palace, we left Marrakesh as the Sun was setting over the mountains and returned to Casablanca in darkness.

P. THOMPSON (Kensington, London).

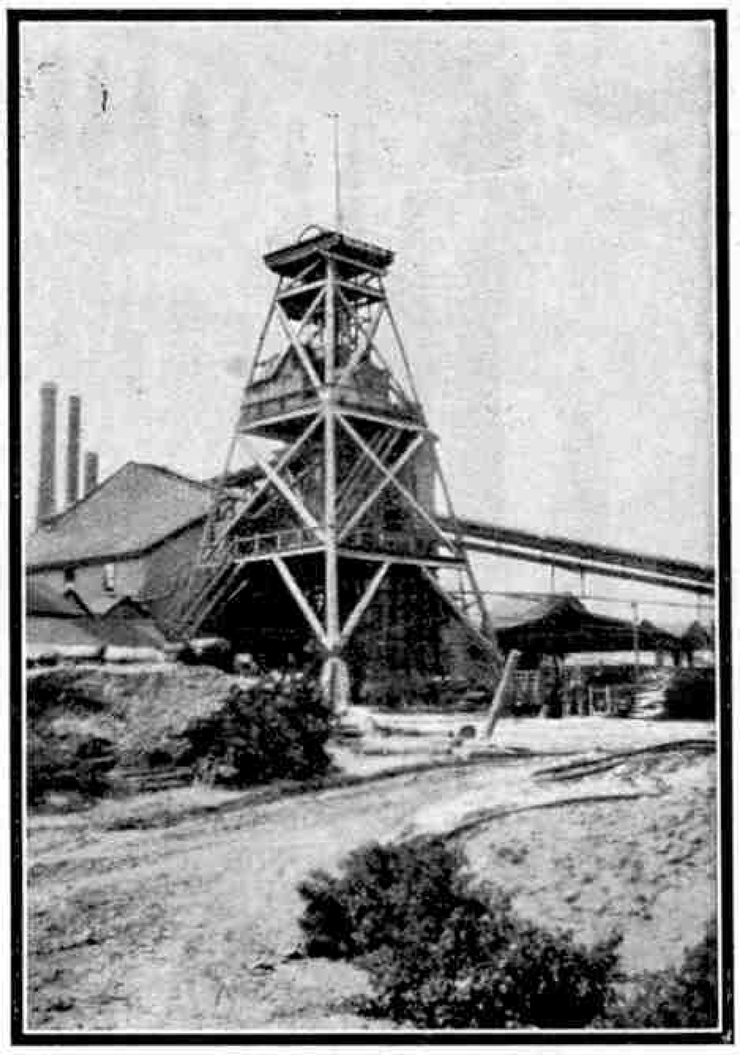
A West Australian Goldfield

During a recent holiday I visited the goldfields of West Australia, about 380 miles east of Perth. I left that city by the "*Kalgoorlie*" one afternoon, and greatly enjoyed the wonderful views from the train as it crossed the Darling Range in the evening. The great wheat areas beyond the Range were passed in darkness, and on looking out next morning I saw that we had reached the uncultivated land near the goldfields. At the side of the line was the 30-in. steel main through which water is pumped to the goldfields from Mundaring Weir, described and illustrated in the "From Our Readers" pages of the "*M.M.*" for September 1932; and occasionally I caught a momentary glimpse of a concrete water tank or a pumping station.

Eventually I arrived at Kalgoorlie, the centre of a famous mining district known as "*The Golden Mile.*" This area of about one square mile is literally covered with mine shafts and ore treating plants. The Great Boulder Mine, the head gear of which is illustrated on this page, is the deepest in the field. Its shaft penetrates to a depth of 2,870 ft., and from it 4,390,100 fine oz. of gold had been extracted up to September of last year.



The Great Boulder Mine, the deepest in "The Golden Mile" of Kalgoorlie. This photograph and the one below are by J. Stanbridge, Perth, West Australia.



The shaft head gear of the Great Boulder Mine, Kalgoorlie.

The story of the West Australian goldfields began as long ago as 1852, when shepherds brought in specimens of gold-bearing rock picked up "somewhere out east." They could not again find the place where they had obtained these specimens, but later gold was discovered on the site of the town of Southern Cross. Then one Saturday in September 1892, those who lived in the newly-formed settlement there were amazed by the arrival of a man named Arthur Bayley, staggering under the weight of 554 oz. of practically pure gold, chipped from the cap of a reef near Coolgardie. This was the beginning of the great gold rush. Stores and offices were deserted, for practically every man in the neighbourhood set out for the scene of Bayley's find, and it is said that the only man who remained in Southern Cross to work was the Registrar of claims, who was beseiged in his office, disturbed at his meals, and even roused from sleep by men anxious to obtain miner's rights and start on "The Golden Trail."

Water was scarce on the new goldfields and its price quickly rose to 2/- per gallon, with the result that many of the eager searchers were forced to return to Southern Cross during the summer. In the following winter thousands of men made their way to Coolgardie. To add to the excitement gold was then discovered at Kalgoorlie, 25 miles further east, and the "roaring days" of gold mining in Western Australia began.

J. STANBRIDGE (Perth, W.A.).

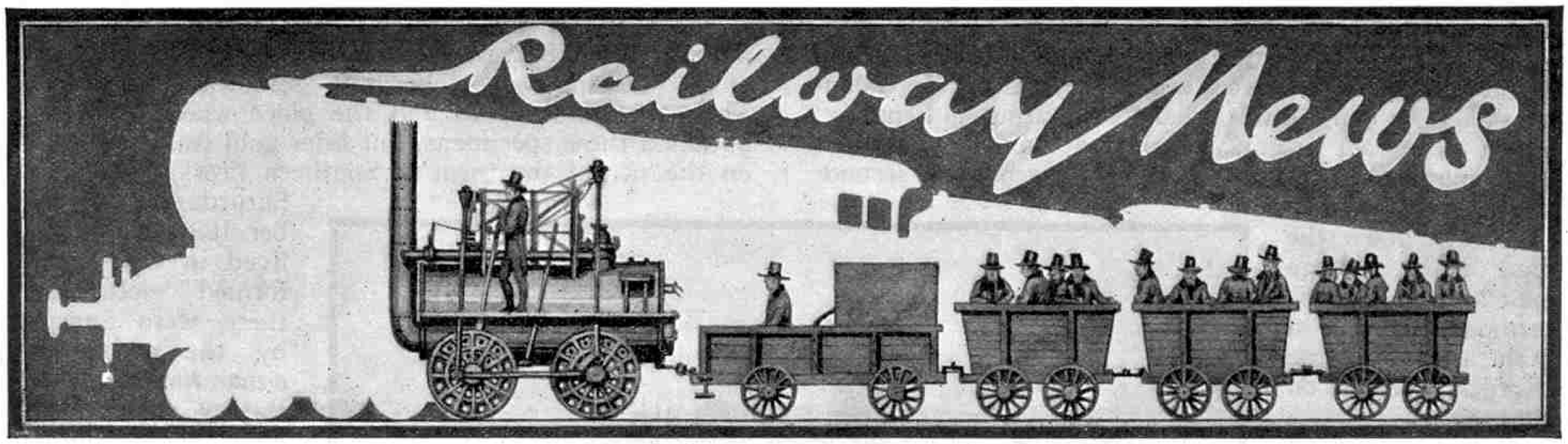
Through the Parsik Tunnel

I was one of a party of 20 people who were given the opportunity of visiting the Parsik Tunnel on the Great Indian Peninsula Railway between Bombay and Poona. This tunnel is nearly a mile in length and was built in 1916 to provide a much shorter and easier route than the line previously in use.

As we entered the Tunnel we felt as if we were entering a room in a giant refrigerator, for the temperature was considerably lower than in the open air. Crystal clear water flowed down the sides.

We made our way slowly down the Tunnel, at the very end of which we could see a tiny speck of light that marked the opposite end. Suddenly there was a tremendous roar as an electric train entered the Tunnel and rushed past us at tremendous speed, the noise echoing and re-echoing from the roof and sides of the Tunnel. This was the "*Deccan Queen*," India's fastest train.

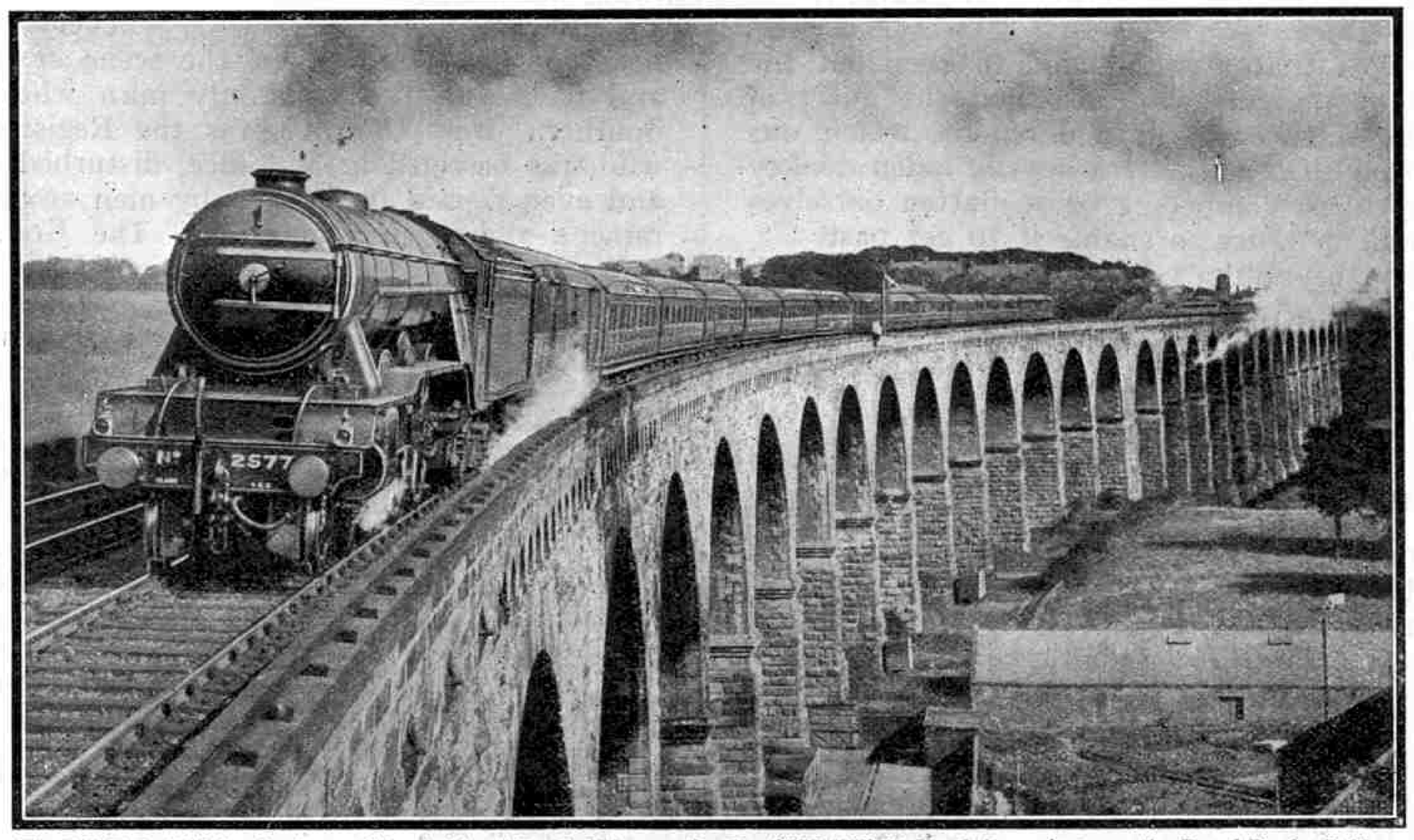
S. D. KURLAWALA (Bombay).



London Passenger Transport Board

Commencing on 1st July, under the provisions of the London Passenger Transport Act, practically all the railway, tramway and omnibus passenger services within an extensive area in and around London come under the control of a special Board appointed for that purpose. The area, which comprises some 1,800 square miles and has a population of about 9,000,000, extends as far as Hitchin in the north, Sevenoaks in the south, Gravesend in the east and Slough in the west. The London Underground and Metropolitan Railways are all combined under the control of the Board and, in addition, the passenger services of the four main line Companies within the area are to be co-ordinated and the whole of the passenger receipts will be pooled. Over 800 passenger stations lie within the area and, as indicating the huge volume of passenger business that will be involved, it may be stated that approximately 1,000,000,000 passenger journeys are made within the area in the course of a year.

It may be confidently expected that the operations of the Board will in time revolutionise passenger transport in the area under its control. Many new facilities are to be provided in the way of through booking arrangements and interavailability of tickets. One possible boon is the provision of a "go-as-you-please" ticket available for any form of public conveyance. It seems likely that some of the new facilities will appeal not only to persons on business bent, but also to enthusiasts who desire to explore the various travel routes in the great area served by the lines to come under the control of the new Board.



The L.N.E.R. "Flying Scotsman" hauled by "Pacific" locomotive No. 2577 "Night Hawk," passing over the Royal Border Bridge, Berwick. The bridge has 28 arches, and was designed by Robert Stephenson and completed in 1850.

Remarkable French 2–8–2 Tank Engines

Some bold departures from normal practice have been made in a series of large 2–8–2 tank engines that are being put into service on the Northern Railway of France. The first of them—No. 4. 1201—has gone through a series of tests with extraordinarily good results. Although its eight coupled wheels have a diameter of only 5 ft. 1 in., it has shown itself capable of hauling a train weighing 480 tons at 70 m.p.h. up a gradient of 1 in 200 and of running at 75 m.p.h. on favourable grades. It covered the 31.4 miles between Paris and Creil in 30 min. 14 sec.

The new locomotives, of which 35 are to be built, are simples and each has two cylinders with a diameter of 25 $\frac{5}{16}$ in. and a stroke of 27 $\frac{9}{16}$ in. The large boiler provides highly superheated steam at a working pressure of 261 lb. per sq. in. A notable feature is the fitting of Cossart valve gear, by which piston valves are operated by cams and exceptional provision is made to secure the free flow of steam into the cylinders and out again, together with the utmost expansion within the cylinders. The weight of the engine in working order is 120 tons of which 86 are carried by the coupled wheels. Two of the Northern "Pacifics" are being reconstructed as two-cylinder simples with Cossart valves and gear.

More "Baby Scots" on L.M.S.R.

Work has been well maintained on the new 4–6–2 "Pacific" express locomotives now in hand at Crewe and the first is almost completed. It is numbered 6200.

The "Royal Scot" locomotive No. 6161, "*King's Own*," which a few months ago had its smoke-box altered and somewhat curiously shaped with a view to obtaining better deflection of smoke and steam, is now running again with a normally shaped smoke-box and with the standard side-sheets as smoke deflectors.

Nine more 3-cylinder 4–6–0 locomotives of the "Baby Scot" class have been turned out from Derby works, so completing the batch of 10 constructed there. They replace engines of the "Claughton" class whose numbers they have taken as follows:—5905, 5933, 5935, 5944, 5954, 5963, 5973, 5996 and 5997. Engine No. 5905 is named "*Lord Rathmore*," all the others being unnamed. There are now 11 "Baby Scots" stationed at Camden shed. One regular booking just allotted to them is that of working the 5.50 p.m. express from Euston to Birmingham and Wolverhampton, returning next morning with the express due at Euston at 10.40 a.m.

The summer timetables will call for smarter running on the part of two of the London-Birmingham expresses. The present 4.35 p.m. down express will start 5 min. earlier, call at Blisworth as well as Coventry, and still reach Birmingham in the even two hours. For the 62.8 miles from Euston to Blisworth, 64 min. will be allowed, and for the 31.2 miles from Blisworth to Coventry, 32 min. The 6.20 p.m. up express from Birmingham, after calling at Rugby in addition to Coventry, will cover the 82.6 miles from thence to Euston in 83 min. and so continue to arrive at 8.20 p.m.

L.M.S.R. Trials of Heavy Oil Locomotives

The L.M.S.R. are about to make extensive trials of heavy oil traction. In addition to the 0–6–0 shunting locomotive, fitted with a 400 h.p. heavy oil engine, which has been constructed in the company's workshops and is now undergoing tests, 11 shunting locomotives are being obtained from outside manufacturers. Three of these will have the 0–4–0 wheel arrangement, the remainder being of the 0–6–0 type. The engines will be of various designs and will be subjected to very thorough tests.

Trials also are to be made with light self-propelled motor coaches, with a view to their replacing heavier steam trains on lines where passenger traffic is light, and for increasing the frequency of existing services.

Orders have been placed with the Leyland Motor Company for three rail coaches capable of seating 40 passengers. These vehicles have a driving compartment at each end, fitted with the necessary control gear and are operated by heavy oil engines.

Three rail coaches have been ordered from The "Sentinel" Waggon Works Ltd. These vehicles have a seating capacity of 70 and are capable of hauling a trailer car, increasing the accommodation to 150. The motive power is supplied by Sentinel Doble steam boilers and engines, the boilers being oil-fired and automatic in operation, thus allowing the unit to be worked by the driver, no fireman being necessary.

Standing Still at 70 m.p.h.

Big parties visiting the G.W.R. locomotive works at Swindon are to be given the opportunity of seeing the engine testing plant in full working order, as this is now included in the programme of the tour of the works.

The plant is the only one of its kind in the country and on it engines may be tested at a speed of 70 m.p.h. while remaining stationary, the driving wheels running on wheels in the plant instead of on rails.

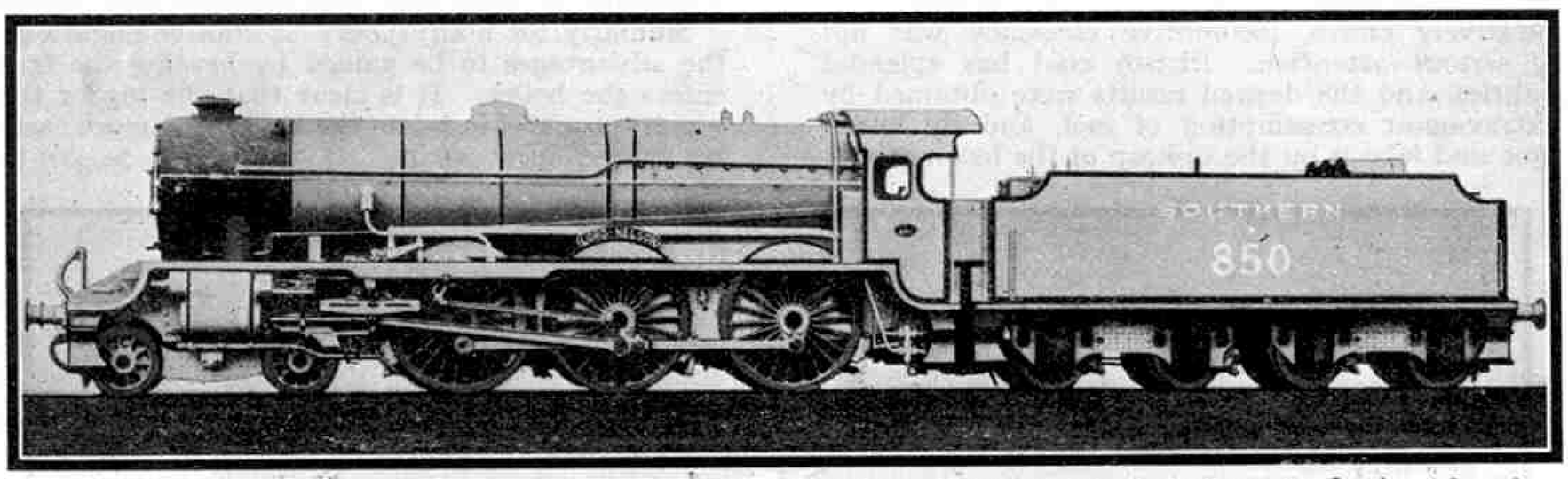
New G.W.R. "Halls" for Holiday Traffic

Work is being pushed forward at Swindon on the second lot of 10 locomotives of the "Hall" class with a view to having them in service by the end of July to assist with the heavy holiday traffic. They will complete the present order for 20 "Halls," and will have the following numbers and names:—No. 5931, "*Hatherley Hall*"; No. 5932, "*Haydon Hall*"; No. 5933, "*Kingsway Hall*"; No. 5934, "*Kneller Hall*"; No. 5935, "*Norton Hall*"; No. 5936, "*Oakley Hall*"; No. 5937, "*Stanford Hall*"; No. 5938, "*Stanley Hall*"; No. 5939, "*Tangley Hall*"; and No. 5940 "*Whitbourne Hall.*"

Rebuilt 2-8-0 Engines for L.N.E.R.

The latest 4–6–0 engine of the B17 or "Sandringham" class turned out from Darlington works is No. 2842, "*Kilverstone Hall.*"

Four of the Great Central 2–8–0 freight locomotives of class O4 have been rebuilt with boilers of the type fitted to Great Northern 2–8–0 engines of the O2 class. They are Nos. 5008, 6271, 6287 and 6371.



"Lord Nelson," the first of the modern S.R. four-cylinder 4-6-0 locomotives. They are used principally on the Continental services between Victoria and Dover, and were designed to deal with 500-ton loads at an average speed of 55 m.p.h.

S.R. Locomotive News

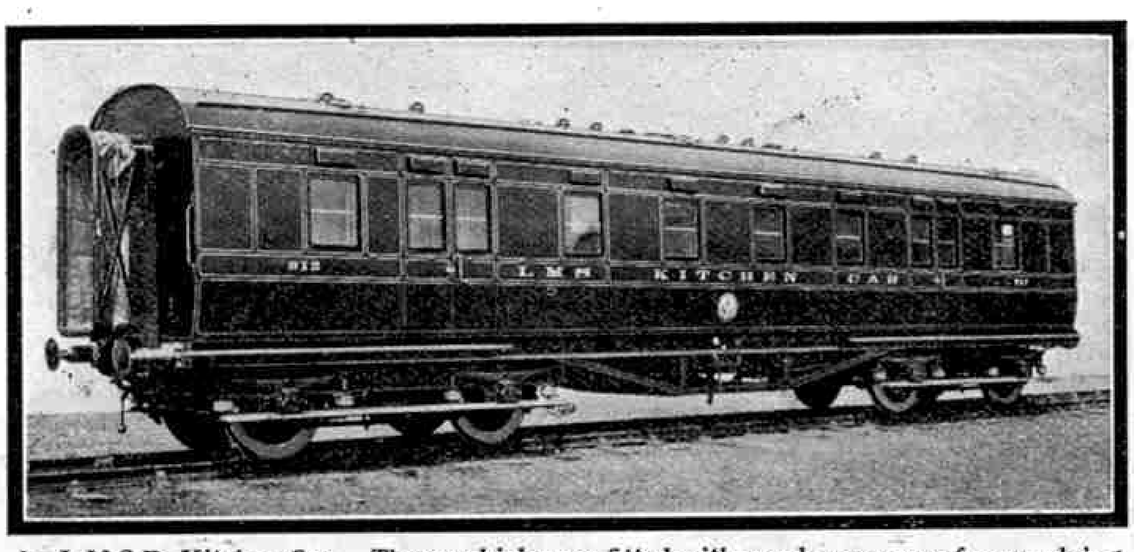
Two more 4–4–0 express locomotives of the "Schools" class have been sent out from the works at Eastleigh and are ready for active service. They are No. 915, "*Brighton*" and No. 916, "*Whitgift.*"

G.W.R. "Speed Up"

Faster trains are to run on the G.W.R. this summer as a result of the completion of big improvement schemes on the main line route to the West of England, South Wales and the North. These schemes include the construction of four miles of new main line at Westbury (Wilts.), and an equal length at Frome (Somerset); the quadrupling of 21¾ miles of lines at congested points at Taunton, Bristol, Cardiff and Olton; and the conversion of 13 stations in the Taunton, Bristol and Swindon areas into four-line stations.

Commencing on 17th July the "*Cornish Riviera Express*" will run "non-stop" from Paddington to Plymouth, 225¾ miles, in 3 hrs. 57 mins. This is 10 minutes quicker than at present and three minutes quicker than during last summer, and Plymouth may now be reached from Paddington in less than four hours.

Other West of England expresses not booked to call at Westbury and Frome, will be similarly accelerated. For instance, the "*Torbay Express*" will cover the 199¾ miles from Paddington to Torquay in 210 minutes—five minutes quicker than last year.



An L.M.S.R. Kitchen Car. These vehicles are fitted with ample resources for supplying the needs of passengers.

Express Railcar on the French State Railways

A "Bugatti" railcar has been built for the French State Railways and will run this summer on a regular schedule between Paris and Deauville, a distance of 137 miles, at an average speed of 69 m.p.h. For this it has an ample margin of power, since it can sustain 100 m.p.h. and has even reached a maximum of 107 m.p.h. The car is 76 ft. in length and 9 ft. 3½ in. in width, and is specially shaped to reduce resistance. It runs on two double eight-wheeled bogies and is propelled by four 200 h.p. motors, which use a benzol-alcohol mixture. The engine compartment is in the middle of the car and has a kind of conning tower from which the driver can see in all directions. The car weighs 23 tons and has seats for 52 passengers.

Luxurious L.M.S.R. Corridor Coaches

The latest third-class eight-wheeled corridor coaches on the L.M.S.R. provide a standard of travel luxury in advance of what has been previously offered to passengers of that class. The compartments are very roomy, with wide, deep windows specially designed to give a full view of the scenery, and with double, draughtless sliding doors opening into the corridor. The walls are panelled with mahogany and adorned with framed photographs and a mirror. Metal fittings are chromium plated. The seats are wide and well sprung and have dividing arm-rests. The upholstery is bright and tasteful, while artistically coloured rubber is used to cover the floor. The lighting, heating and ventilating equipment is of the latest and best type. The new coaches, which have metal bodies and run very smoothly, are now to be found on various services.

A Pullman Puzzle

A traveller visited a Pullman agent in order to make enquiries about a berth for a long railway journey he was about to undertake. He had never before travelled by Pullman and had vague ideas about accommodation.

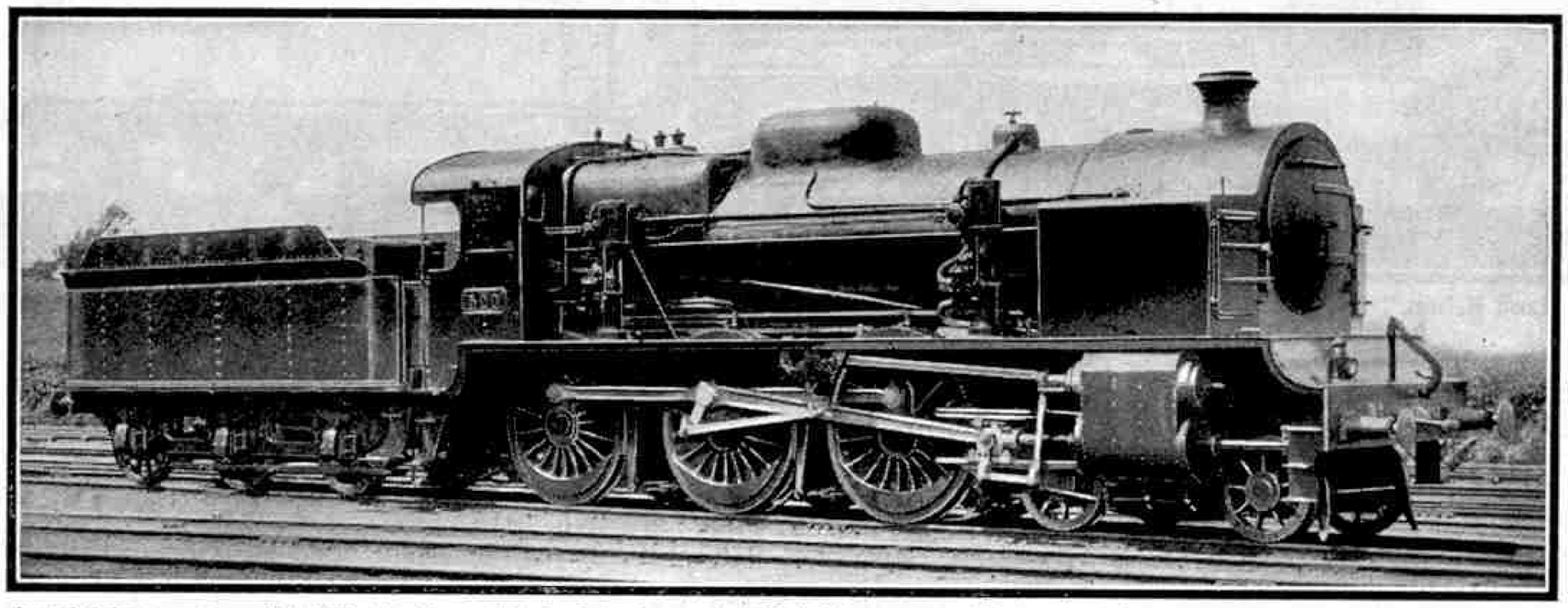
"Upper or lower?" asked the agent. "There's a difference in price. The lower berth is higher than the upper. The higher price is for the lower. If you want it lower, you'll have to go higher. In other words, the higher, the lower. Most people don't like the upper, although it is lower on account of its being higher. When you occupy an upper you have to go up to go to bed, and get down when you get up. You can have the lower if you pay higher. The upper is lower than the lower, because it is higher. If you are willing to go higher, it will be lower."

"Guess I'll go to the car in which they just sit down," replied the man who thought he wanted a berth.

The Search for Locomotive Economy

I.—Development of Feed-Heating Systems

DURING the prosperous years of the pre-war period when coal was comparatively cheap, locomotive efficiency was not given very serious attention. British coal has splendid steam-raising qualities, and the desired results were obtained by comparatively extravagant consumption of fuel, and by lavish expenditure of time and labour on the upkeep of the locomotives. Since the War the changed conditions have made economy in every direction an urgent necessity, and engineers have given steadily increasing attention to the improvement of the efficiency of their locomotives. Generally speaking the object aimed at is to extract the fullest value from each pound of fuel burned on the grate, and the methods of achieving this are numerous. The most important of them are high boiler pressures and long valve travels, giving more expansive working; the use of poppet valves for steam distribution; compounding, and feed-water heating. One or more of these features is incorporated in all the latest designs of locomotives.

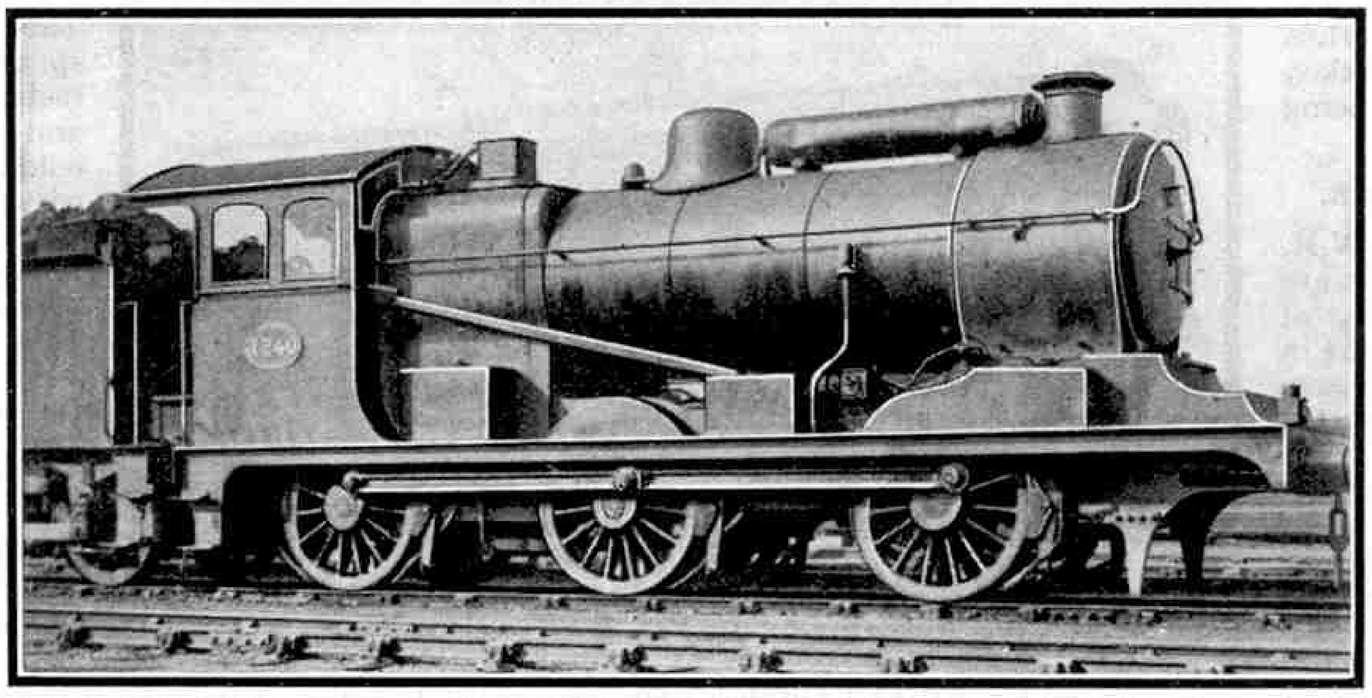


A 4-6-0 locomotive with "Bredin-Burnell" feed-heater and "Weir" pumps. Photograph by courtesy of the G.S.R. of Ireland.

The superheater is now regarded as an essential fitting, and its use was a recognised practice before the War. To the G.W.R. belongs the credit for having successfully adopted high steam pressures, enabling long-travel valves to be notched up to an early cut-off with full regulator working. This has been standard Swindon practice for more than 25 years. As regards compounding, the Midland Railway adopted the Smith system that was originated on the N.E.R., and by 1909 had 45 engines running with the system as modified in detail at Derby. The first engines, which incorporated the actual Smith arrangement, appeared in 1902 about the same time as the first G.W.R. express 4–6–0 No. 100, later No. 2900, "*William Dean*," which set the fashion for subsequent Swindon designs.

We have dealt in previous articles with high boiler pressures and poppet valves. Both of these, and compounding also, involve changes in the essential design of the locomotives concerned, but feed-water units of modern pattern may be readily applied to existing types. In locomotive practice, as in other spheres, there is nothing new under the Sun. Schemes and principles that are successfully incorporated in present-day designs were in many cases known at quite an early period, but practical difficulties in their application caused their introduction to be postponed until a later date. Thus a partially-successful superheater was devised as early as 1839 by R. & W. Hawthorn, and the well-known J. E. McConnell on the L.N.W.R. introduced two different types with modifications in 1852 and 1859. Finally the efforts and experiments of Dr. Schmidt in Germany resulted in his efficient smoke-tube apparatus of 1902 that was adopted here and on the Continent.

Similarly for many years locomotive engineers have recognised the advantages to be gained by heating the feed-water before it enters the boiler. It is clear that the higher the temperature at which the water is fed to the boiler, the more easily will that water be turned into steam. If the water is pre-heated, therefore, there will be less difference in temperature between this water and the boiler, and the stresses on the latter are much reduced when differences of temperature within it are obviated as far as possible. A boiler that is not subjected to sudden changes of temperature will keep in better order and give far less trouble in maintenance than one that has been roughly treated in this way. It has been calculated that for every 11 deg. F. that the temperature of the water is raised before introduction to the boiler, a saving of about one per cent. in coal consumption can be effected, so that the fuel economy of a good feed-heating system is apparent.

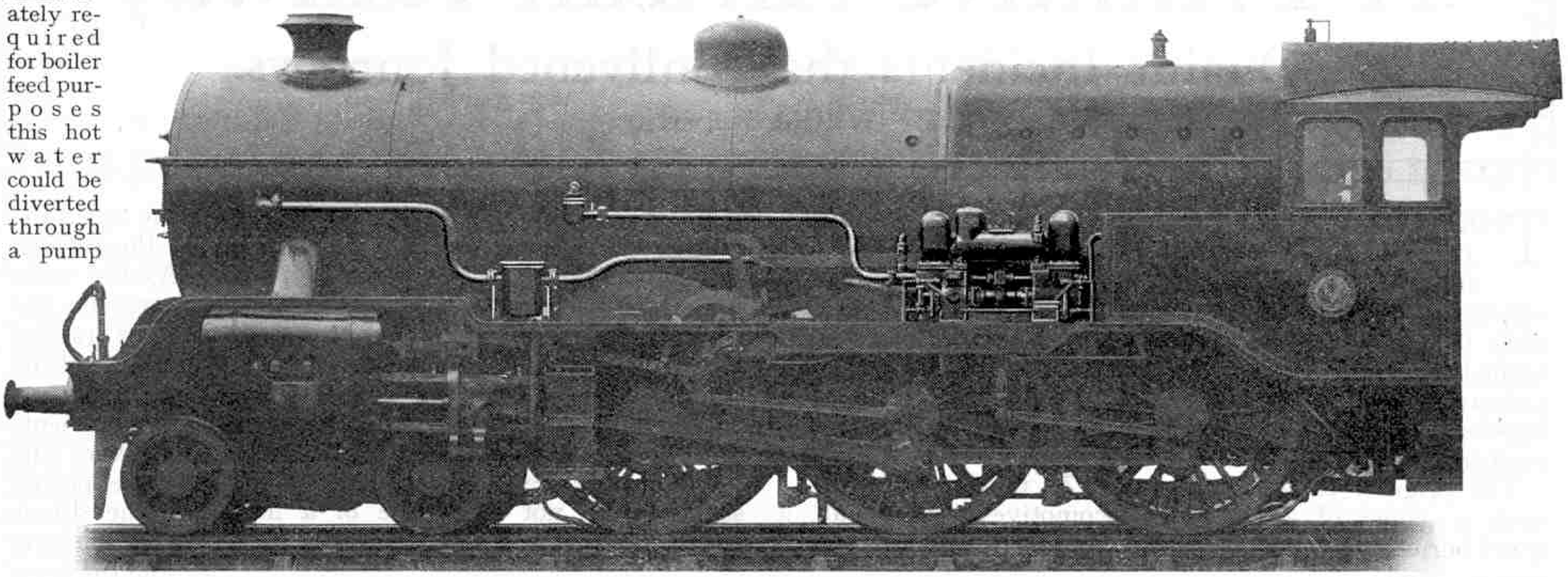


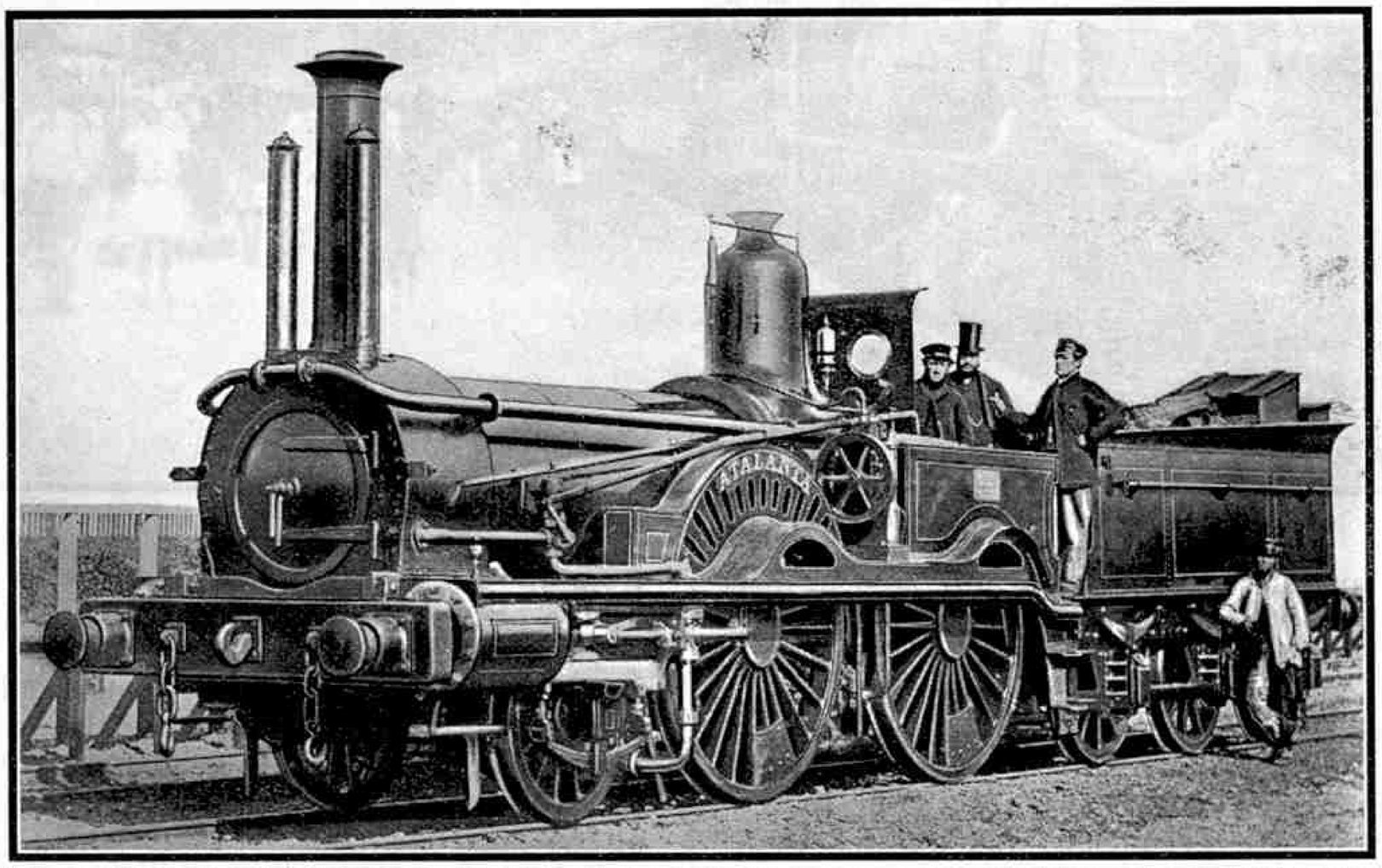
A G.E. section 0-6-0 locomotive fitted with feed-heating apparatus of the "A.C.F.I." pattern. The water cylinder is mounted on the boiler. Photograph by courtesy of the L.N.E.R.

Various problems attend the preheating of the feed-water, however. One of the chief of these is that the injectors usually employed for supplying locomotive boilers with water do not work satisfactorily with hot feed-water. Pumps have to be used instead, and although many experiments have been made, engineers seem to have found it difficult to produce a pump that can be thoroughly relied upon under all conditions of service, and whose maintenance in good repair does not outweigh its advantages.

During recent years the question of feed-water heating has received increasing attention, and although the practice is as yet applied only to a limited extent in Great Britain, it is more or less universal on the Continent and in America. Many of the special external fittings that make foreign locomotives look so ugly to British eyes are used in connection with this practice. Several years ago Mr. Joseph Beattie, on the London and South Western Railway, had his form of feed-water heating apparatus fitted to engines under his charge. This engineer was a great locomotive experimenter, and with his contemporaries McConnell on the L.N.W.R., and Cudworth on the S.E.R., produced numerous systems for economising in one direction or another. In a paper read before the Institution of Mechanical Engineers, Mr. Beattie stated that at average speeds of 30 m.p.h. the coke consumption was 17.1 lb. per train mile, 8.3 lb. of water being evaporated by 1 lb. of fuel. Beattie's earliest form of feed-water heating apparatus involved fitting to the engine an arrangement that gave it the appearance of having several chimneys. These extra fittings were condensers, however, in which the exhaust

steam from the cylinders, having first passed through a tubular heater, met a jet of cold water pumped from the tender. The resultant hot water was delivered into a pipe by which it travelled back to the tender, where it helped to heat the cold water, or if immediately required for boiler feed purposes this hot water could be diverted through a pump that delivered it into the feed-heater, and so to the boiler. One fault of this system was that the oil in the exhaust steam was returned to the boiler with the hot feed-water, and this is undesirable for several reasons. In a later arrangement the jet condenser scheme was abolished. A branch was taken from the blast pipe, and was joined at the side of the smoke-box by a cold water pipe connected to the cold water pump. From this point this cold water pipe was encased in the larger steam pipe. The exhaust steam contained in this thus surrounded the inner one and so heated the water within it, which was fed to the boiler by means of a donkey pump at the side of the engine.





The upper illustration, for which we are indebted to the L.M.S.R., shows a four-cylinder 4-6-0 locomotive, No. 10434, fitted with "Dabeg" feed-heating apparatus. Below is an old L.S.W.R. 2-4-0 locomotive, "Atalanta," fitted with the "Beattie" jet-condenser system of feed-heating. Photograph by courtesy of the Southern Railway.

This form of apparatus appears to have been quite successful and good results were obtained, the fuel consumption of the engines so fitted being very low. The following figures relative to the performances of the engines may be of interest. Starting from Waterloo with the feed cold at 69° Fah., the temperature of the water delivered to the boiler was 120° after starting and 174° at the end of a run to Windsor, where the tender water had attained a temperature of 86°. On the return journey a maximum feed temperature of 184° was reached, 164° being the average. It must be remembered of course that the tender water had been warmed up on the journey down, so that improved figures on the up trip would be expected.

After Mr. Adams took charge at Nine Elms no further engines were fitted with the apparatus, and the old ones disappeared gradually, but subsequently Mr. D. Drummond fitted a number of engines on the L.S.W.R. with his system of feed-water heating. He turned a portion of the exhaust steam into a heater situated below the tender tank. In this heater water from the tank surrounded the tubes through which this exhaust steam passed, and its temperature was thus raised. A duplex pump was employed for delivering the water to the boiler. This water was still further heated in later engines by passing it through a coiled pipe in the smoke-box before entering the boiler at the front tube plate. Mr. Drummond stated that an average saving of 13 per cent. in fuel resulted from the use of this system, the feed-water being delivered to the boiler at a temperature of 200 deg. F.

A simple form of feed-water heating apparatus was applied about 1860 to some engines on the Stockton and Darlington Railway. This was devised by the locomotive engineer William Bouch, and consisted of a wrought-iron water jacket round the chimney, so that the apparently clumsy appearance of the latter may be imagined. Cold water from the tender was pumped into this chamber, where the exhaust steam and gases passing through the chimney raised its temperature. A pipe led the hot feed-water from the bottom of the jacket to another pump, and so into the boiler. If necessary the heater could be dispensed with and cold water fed directly into the boiler. In spite of its apparently primitive nature this form of apparatus is said to have worked well, but this did not prevent it from being known by the enginemen as "Bouch's coffee can!"

As Locomotive Superintendent of the L.B.S.C.R. from 1871 to 1889, Mr. William Stroudley was a firm believer in the use of pumps, and in his engines these were driven off the motion. The objection to pumps of this type is that no water can be fed into the boiler when the engine is stationary, so that it was often necessary for engines to run backward and forward in the locomotive yard before proceeding to their duties in order to fill up the boiler. His system of heating the feed-water by means of the exhaust steam resulted in a substantial economy in fuel to the extent of 2.9 lb. per mile, and the water is said to have been raised to boiling point under ordinary conditions.

The experiments that were initially made by famous engineers of past generations have in late years had important developments that may result in a far more general application of the principle of feed-water heating. Although, generally speaking, the practice has not been popular in Great Britain owing to defects of various systems, several engines from time to

(Continued on page 568)

A Primitive African Railway

Quaint Incidents that Enlivened Journeys

By Wilfrid Robertson

THE old Lomagundi line that connected Salisbury, the Rhodesian capital, with the Eldorado gold mine in the Lomagundi district, is already becoming only a memory. Twenty years have passed since it was superseded by the standard gauge and extended in length, but those who travelled on the earlier railway will ever retain vivid memories of it. Journeyings on that line were always open to enlivenment by unexpected happenings.

The original railway was some 70 miles in length, with a gauge of 24 in. The locomotives were small wood-burning engines of a size proportionate to the gauge, and the trucks were in keeping with the motive power. The passenger-coach—there was only one—was of the shape and size of a small tram-car, with hard wooden seats running lengthways therein, and no other amenities whatsoever.

The Beira Railway to-day ; arrival of the mail train at Broken Hill.

This coach was for the use of the white passengers ; the native travellers were accommodated in an empty covered truck. The duration of the journey over those 70 miles was scheduled at 10 hours, 8 a.m. to 6 p.m. ; but it was seldom that the bi-weekly train reached its destination less than an hour late, and often it was midnight before it arrived at the terminus. Still, as the railway company argued, even that was quicker than walking the distance !

There were many delays to augment this slowness of progression. Halts every few miles were necessary to load up the diminutive tender with cord-wood from the stacks dumped at intervals along the line by gangs of native woodcutters. Water also had to be taken frequently, and it was not an unknown occurrence to find either that the native in charge of one of the squeaky handpumps had forgotten to fill the supply-tank, or that one of the pumps themselves had broken. During the halts for refuelling the passengers left the train and walked briskly forward along the line to stretch their cramped legs. When the train started again and caught them up it was an easy matter to board it once more as it passed, for, except down a hill, the speed seldom exceeded eight or ten miles an hour.

But the main interest in the journey came from the halts not contemplated by the compilers of the printed timetable of which they were so proud. As the train pursued its way over the uneven metals it was no uncommon thing for the handful of passengers to be startled by a couple of resounding reports from the direction of the engine, followed by a grinding and squealing of brakes. The man unused to Rhodesian ways would have a momentary vision of burst steam-pipes and a scalded driver ; the old hand, however, would know that the unexpected sounds were not indicative of a mishap. The driver usually carried a shot-gun in the cab of his locomotive, and the noise indicated that he had shot a brace of guinea-fowl from the footplate, and was stopping the train so that his native fireman could run off into the 'bush' and retrieve the game. If the driver carried a rifle as well, antelope also were shot sometimes from the footplate, and the train was halted while the native passengers turned out to carry the fallen beast to the edge of the rails and lift it into an empty truck. Fresh meat was always welcome, and portions of the venison were left at the tiny settlements along the line. Drivers were not the only sportsmen, however, for there is on record the shooting of a bull elephant from the window of the passenger-coach.

Delays due to mechanical defects were frequent, the most common of breakages being that of couplings. These were of the old-fashioned hook and link type, and the heavy oval links were rusty and often half-divided by invisible cracks. A sudden strain, such as restarting the train at a wayside siding, would prove too much for the metal ; the engine and the front trucks would move joyfully forward, leaving the rest of the train stationary. Unless the position were upon a curve the driver was often unaware of the mishap, for his backward vision was restricted by the trucks behind the tender, and there were no communication-cords or vacuum-brakes to give him notice. Shouts from those in the abandoned section, and a hasty pursuit by the guard, were necessary to draw the driver's attention to the fact that, as the native fireman put it, his tail had broken off. And in railway

circles it was considered bad form for a driver nonchalantly to reach his destination with only a quarter of the rolling-stock with which he had been entrusted!

Spare coupling-links were carried, but sometimes the supply was not equal to the demand. In the event of such an occurrence there was no cause to be perturbed, for usually one of the trucks contained a roll or two of that universal Rhodesian tying medium—fencing wire. Heedless of the probable protestations of the consignee, a roll would be appropriated and a stout lashing of many turns manufactured in a few minutes to replace the missing connection. It took much to beat the resourcefulness of those who worked the old Mashonaland Railways.

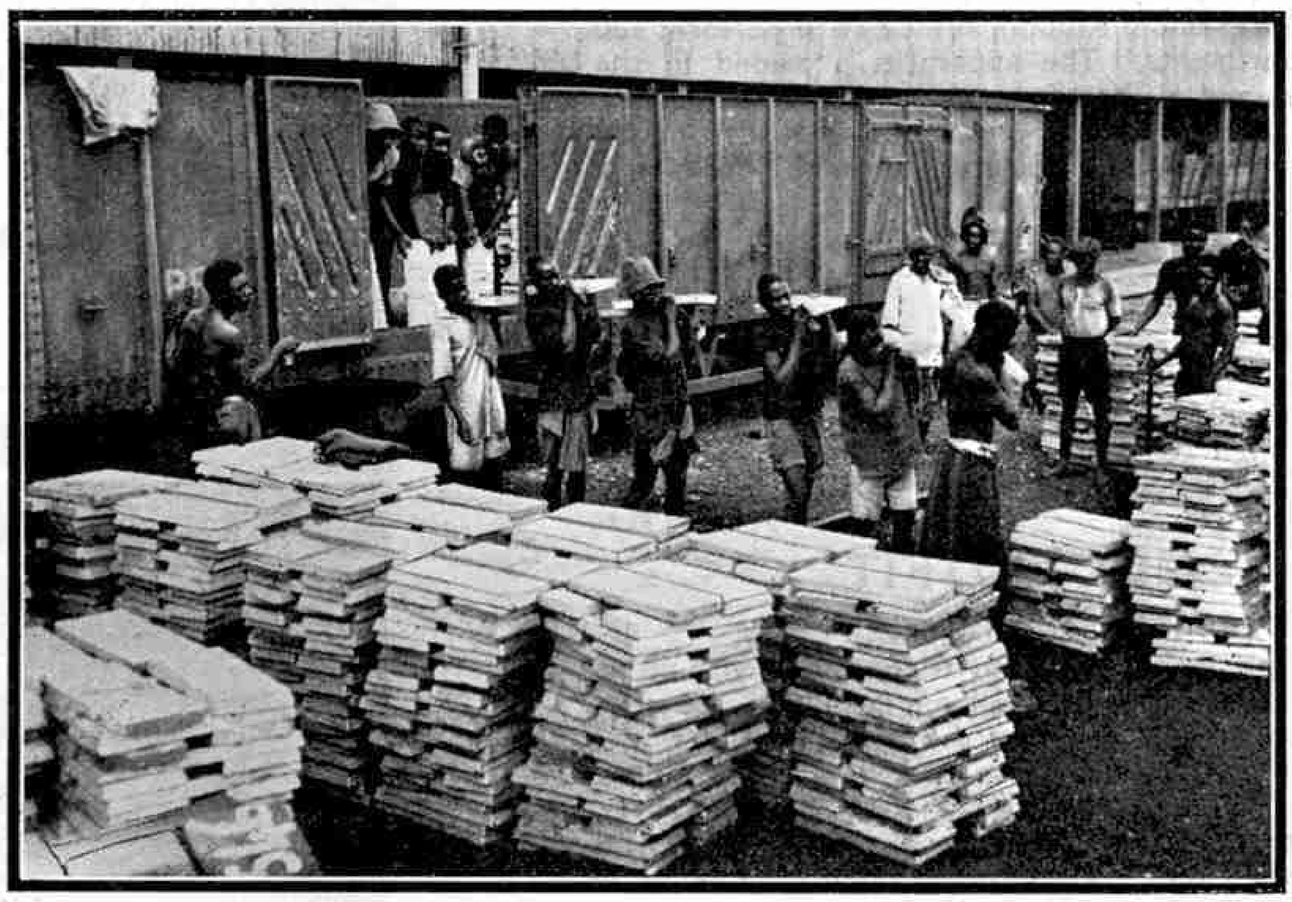
One of the original Beira Railway locomotives transferred to the Lomagundi Railway when the Beira line was altered to standard gauge. For the illustrations to this article we are indebted to Rhodesia Railways Ltd.

Owing to the complete absence of catering accommodation, those on the train carried with them food and drink for the day. But with the heat, and the dust rising from the sandy track that wound through the endless ranks of trees, seldom did the supply of liquid refreshment equal the demand; and the arrival at one of the two sidings blessed with a primitive store and canteen was the signal for a general exodus from the train.

Perhaps the choicest memory of those old days was that of the man who dropped his false teeth off the train. The teeth were valuable, and time was not. The driver obligingly backed the train several miles, and waited while the bereaved passenger recovered his dentures. Anyway, wood-fuel was cheap!

The line was built on the least-resistance principle—it meandered along wherever the most suitable going presented itself. Rises of ground could not always be avoided, however, and these inclines were considerable obstacles to the low-powered locomotive. The only method of negotiating them was to turn on steam to its fullest extent on the down-grade—accelerating to a crazy speed of 18 or 20 miles an hour!—in the hope that the velocity thus gained would sufficiently assist the wheezing cylinders to carry the train up to the opposite crest. Twenty miles from the terminus was a slope known as the Banket rise, the uninterrupted ascent of which was always a feat. I have known a train to make three attempts before reaching the crest, each failure being followed by a retreat to more level ground in order to recover speed for the breasting of the incline.

Branches of trees arched over the line, and the long grass grew so close to the metals that its windswept crest brushed against the passing train. During the dry season, when the country was being swept by the annual grass-fires, it was not uncommon for the driver of the train to find himself progressing towards a raging inferno of advancing flame. There was no retreat, but luckily the flaming wall was never great in depth. The driver whipped up his engine to its utmost activity, while the passengers behind him relinquished their seats for the middle of the swaying coach. A blast of flame, a crackling roar, a wave of intense heat—and the train would be running in the blackened and smoking wilderness over which the fire had passed. After a halt had been made to see that none of the woodwork had taken fire the journey was continued; but it was a nervous business if one knew that the adjacent truck carried a large consignment of blasting-explosives!



Natives off-loading zinc billets at Broken Hill.

The worst and slowest journeyings were necessarily those undertaken during the rainy season, when bridges and culverts were liable to be washed away, and the line to sink into quagmires. At that time of the year one never knew what the next curve of the line would disclose, for the sudden and violent storms that swept continually across the country could effect in a few minutes considerable damage to the light and sand-ballasted line. It was no uncommon thing to be held up for hours awaiting the subsidence of a roaring torrent of water that was sweeping its wide course across the metals, a wait usually rewarded by the subsequent discovery of a gap in the track a hundred yards in width. Retreat was the only alternative, and sometimes even that was found impossible, another storm having removed the rails over which the train had just passed. If there were a farmhouse anywhere in the vicinity food and shelter could be obtained; if not, the passengers and crew had to tramp as best they could to the nearest white man's habitation.

During the rains subsidences of the track were a regular occurrence, the weight of the light locomotive being sufficient to press down the metals and iron sleepers till they disappeared from view.

(Continued on page 563)

KEMEX

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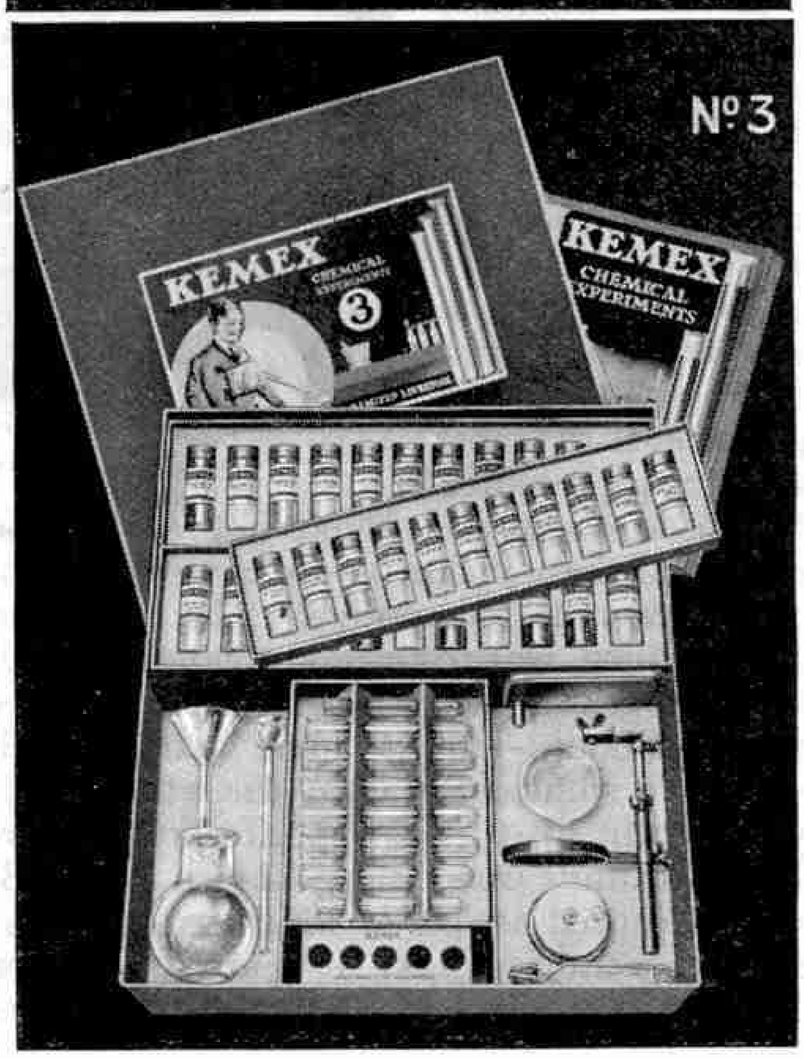

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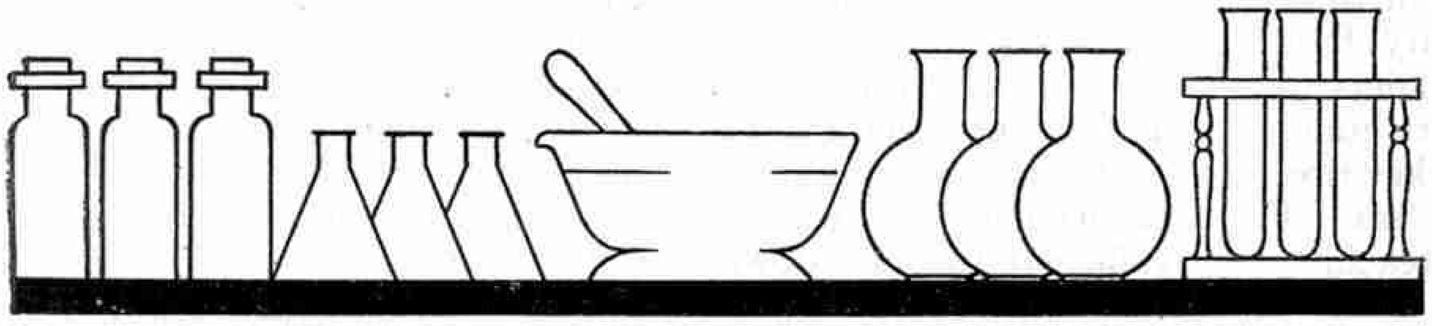
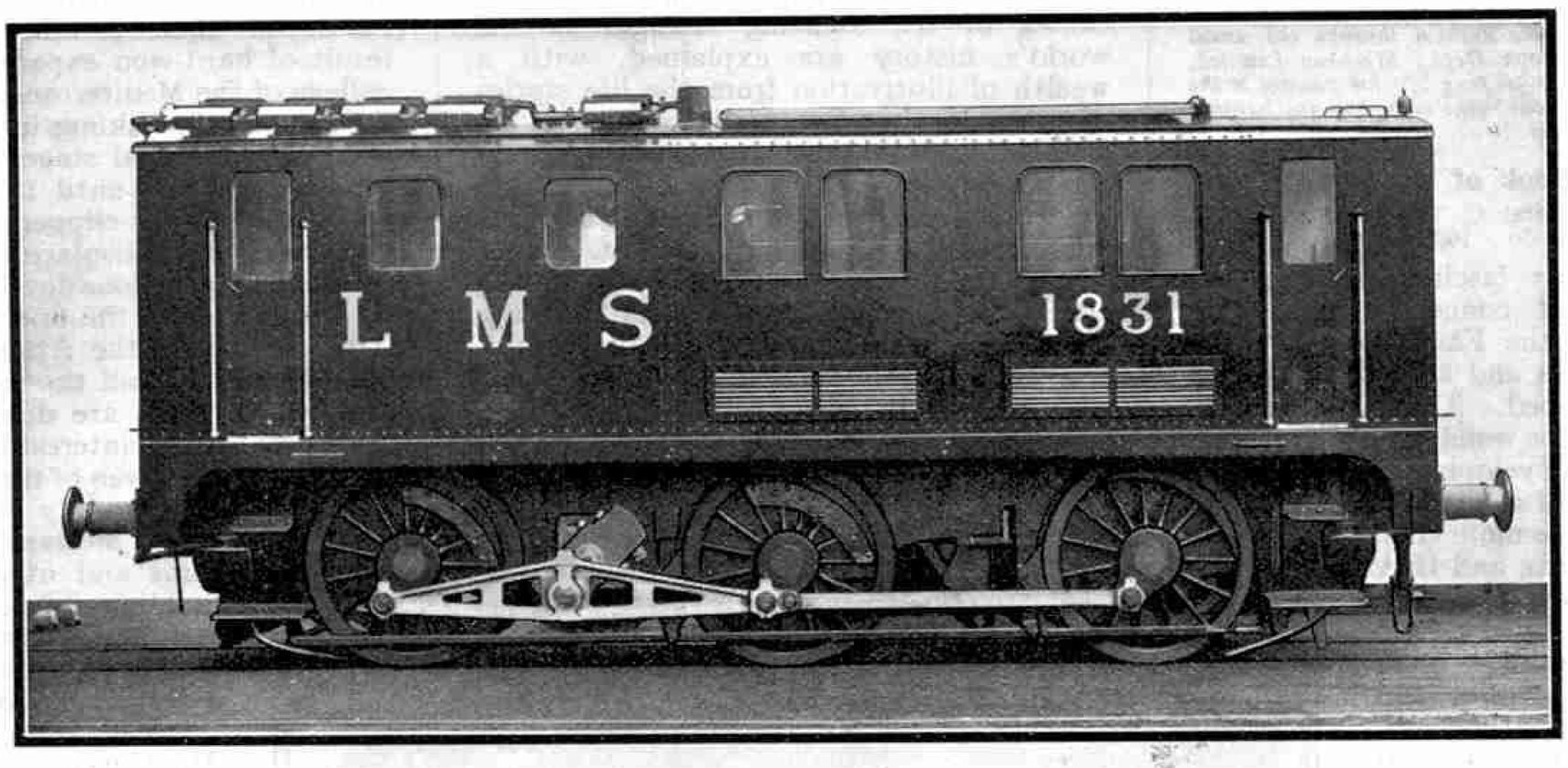


A Heavy Oil Shunting Locomotive

Interesting L.M.S.R. Experiment

DURING recent years locomotive engineers have devoted considerable attention to the economical operation of locomotives in general. A revival of interest in rail motor coaches has taken place, with the object of providing a light, economical and mobile unit for branch line work. Motor coaches of various types were very popular some 25 years ago, and practically all the important British railways had some of them. In most of these coaches the power units followed in their design the ordinary locomotive practice of the day, and they were found less successful than had been anticipated. More recently the application to this type of vehicle of high-speed steam engine units geared to the road wheels, and of thoroughly efficient boilers working at moderately high pressures, has produced such designs as the "Sentinel" and "Clayton" steam rail coaches. The "Sentinel" shunting locomotive incorporates the same principles for light yard work. The L.M.S.R. and the L.N.E.R. both have locomotives of this type in service, and many have been supplied for works purposes and for use abroad.



The shunting locomotive described in this article, as reconstructed from an ordinary 0-6-0 steam tank locomotive. It incorporates a six-cylinder heavy oil engine with hydraulic transmission, and has been assembled recently by the L.M.S.R., to whom we are indebted for this photograph. It is at present undergoing a series of tests at Chaddesden sidings near Derby.

Engineers interested in systems of power development other than steam have also given their attention to the problem of providing economical units for light duties. Internal combustion locomotives for shunting have been in use for some time. Experiments with petrol vehicles were once made by the G.N. and L.B.S.C. railways, and the North Eastern Railway had an inspection car so propelled as early as 1908, and others were subsequently built. The petrol-electric system was also applied on the N.E.R., and experimentally on the Great Central and Great Western railways. A Diesel-electric locomotive built for the Canadian National Railways was described in the "*M.M.*" for May, 1929, and Diesel-electric rail cars are in use on that system and elsewhere. The L.M.S.R. have had a Diesel-electric train in operation in the Blackpool district for some time. The Diesel-electric car "*Tyneside Venturer*," of the L.N.E.R., completed six months' service in October last, during which period 25,000 miles were covered with very satisfactory results, the fuel and oil costs working out at less than ¾d. per mile. This car incorporates a 250 b.h.p. Armstrong-Sulzer six-cylinder engine, the working parts of which, upon examination at the end of the period, were in excellent condition.

The L.M.S.R. have made an interesting experiment in the assembly of a shunting locomotive of the 0–6–0 type with a 400 b.h.p. heavy oil engine. This recalls the L.N.E.R. tests of 1924, when an Austrian-built Diesel locomotive made a number of trips on the G.E.R. section of that line. This locomotive had a six-cylinder Diesel engine of 60 h.p., with hydraulic transmission, and was apparently fairly successful. In the L.M.S.R. locomotive an old 0–6–0 shunting engine has been utilised but, as the accompanying photograph shows, the present unit bears little resemblance to the original. A box-like casing covers the heavy oil engine, which has a normal running speed of 750 r.p.m., and was supplied by Davey, Paxman & Co. Ltd. of Colchester. The radiators for cooling the circulating water and oil for the engine are mounted on the roof at the leading end.

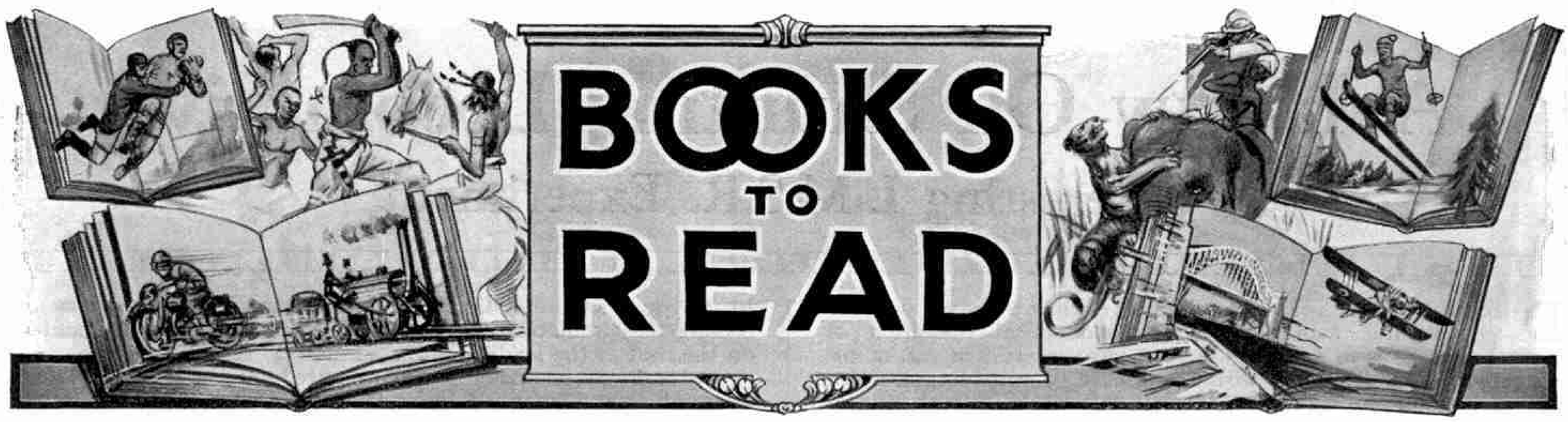
Hydraulic transmission is incorporated, and the transmission gear, which was supplied by Haslam & Newton Ltd., of Derby, consists of a pumping unit and a transmitter unit, the former being capable of absorbing 400 b.h.p. continuously when running at 750 r.p.m. The main shaft of the engine is directly coupled to the pumping unit by means of a universal coupling, and the pump transmits its power hydraulically to the transmitter unit. The latter is capable of infinite variation in speed in either direction from zero to a speed equal to a rate of 25 m.p.h. on the road, the variable torque ratio under these conditions being from 1 to 5. At each outer end of the transmission shaft there is a crank arm with a special flexible crank pin, which allows for the up and down movements of the coupled wheels relative to the fixed position of the transmission shaft. This flexible crank pin is connected to the leading and intermediate driving wheels by means of a Scotch yoke coupling rod, and the crank and driving arrangements are shown in the illustration.

Compressed air brakes are employed, with cylinders and brake rigging of the usual type. It is also possible to operate trains of vehicles fitted with the vacuum brake, an exhauster being connected to the main shaft by a dog clutch, the drive through which is disconnected when the air brake only is required. Hand brakes are also provided, with screw control in each of the two driving compartments.

Special attention has been given to the convenience of the driver, a matter of importance in any case, and especially in shunting. The controls are therefore arranged so that they can be operated from either side of each driving compartment. A vacuum gauge is fitted in connection with the vacuum brake system, and the air pressure brake has a corresponding pressure gauge. A gauge showing the pressure of oil in the lubricating system, and a torque gauge, indicating the power being developed, are also provided. In addition the leading compartment has a gauge showing the pressure of the transmission oil, and in the trailing compartment the pressure of engine fuel oil is registered.

The air pressure, in a large and a small main reservoir, is maintained at 300 lb. per sq. in. by a two-stage compressor of approximately 5 h.p., normally driven off the main shaft. To charge the reservoir when the main engine is not running, a small petrol engine is provided. From the reservoirs air is supplied to the main engine at 300 lb. per sq. in., and through reducing valves at a pressure of 160 lb. to the air brake cylinders, and at 10 lb. to the fuel oil and gear oil tanks.

The performance of the engine is being carefully observed, and it will be interesting to see what developments occur as a result of the experiment, in view of the possibly extensive use to which units of this kind could be put.



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"A Picture Book of Evolution"

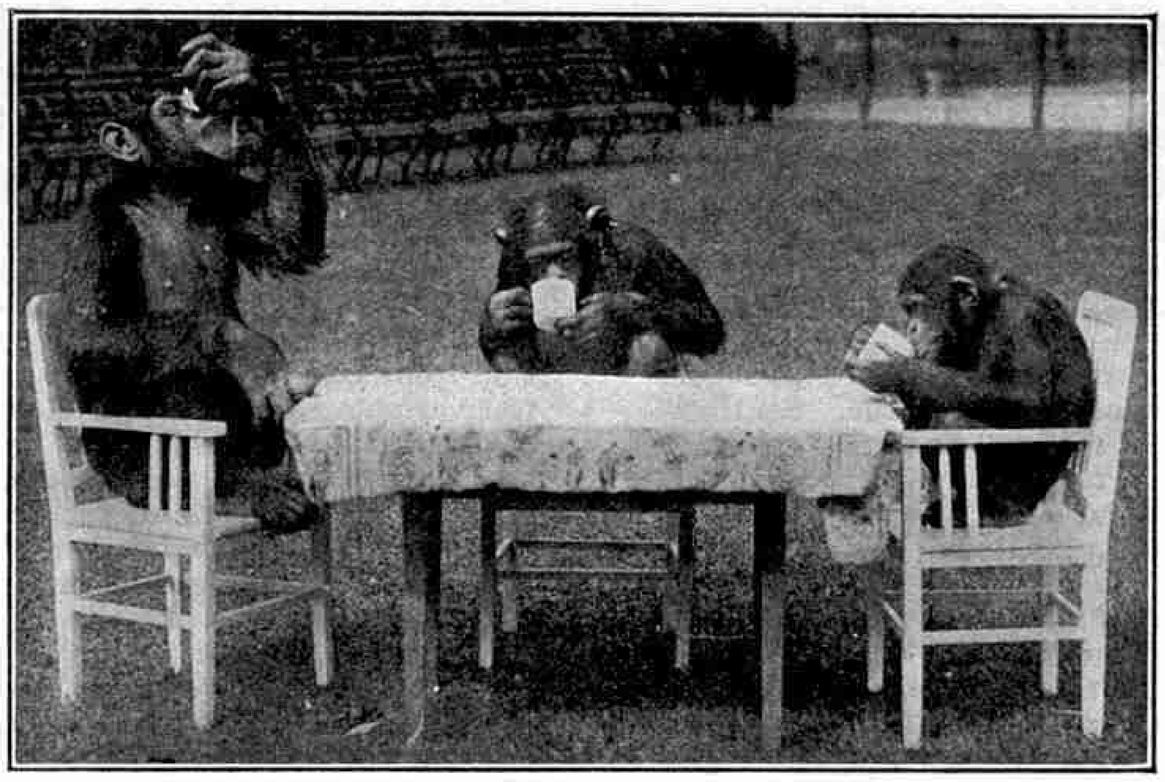
By Surgeon Rear-Admiral C. N. Beadnell, C.B.
(Watts & Co. 10/6 net)

One of the most fascinating branches of science is that concerned with the manner in which the Earth was formed, and how the plants and animals that live on it have developed. The main aim of this book is to tell the wonderful story of this development, chiefly by means of a series of pictures. There are more than 260 of these pictures, and they illustrate the story of evolution by reference to things with which we are all familiar in our homes, in our streets and waysides, and in the heavens. The descriptive matter that accompanies the pictures explains their various features in a simple and attractive manner, and enables us to follow the steps by which our Earth came into being, and to understand how the simple early forms of life have been transformed into the plants and animals of to-day.

The author begins by explaining the meaning of evolution. He makes this simple by comparing the development of complicated machines from very crude beginnings with the gradual change of the earliest-known horse, a creature about the size of a terrier, into the magnificent animal that has served Man so well. He then traces the changes that the crust of the Earth underwent from the time when it was molten to the first appearance of life, and describes the chief features of the amazing series of plants and animals that appeared during the succeeding ages. The story brings us to the present time when mammals are supreme, and Man, the thinking animal, is master of the Earth.

The most interesting part of the book deals with the origin of Man. The family to which he belongs is probably descended from a primitive insect eater of millions of years ago, and it is fascinating to compare Man's structure with that of the apes, his nearest relations in the animal world. We gain a new respect for the intelligence of these creatures, particularly the chimpanzees, who are readily teachable. The accompanying photograph shows the famous chimpanzees' tea party that forms one of the most popular features of the London Zoo.

Finally come chapters in which the causes of the amazing changes in the world's history are explained, with a wealth of illustration from the life stories of animals that are well known to us. The important and interesting fact is clearly brought out that evolution is still at work, and that the world and its inhabitants are changing slowly but of course almost imperceptibly. Examples are given of Man's own efforts to bring about similar changes in certain plants, and it is interesting to compare these with the results of evolution.



A Tea Party at the London Zoo. The chimpanzee is the most teachable of all the man-like apes. (From "A Picture Book of Evolution" reviewed on this page.)

A valuable section of this fascinating book is a series of short biographies of scientists who, by their researches, have helped to unfold the story of evolution.

"The Modern Boy's Bookshelf"

"The Romance of the Merchant Ship"
By Ellison Hawks

"The Book of Remarkable Machinery"
By Ellison Hawks

"The Boy Electrician"
By Alfred P. Morgan and J. W. Sims
(G. G. Harrap & Co. Ltd. 5/- each net)

This new series has been introduced with the special object of supplying the demand for moderate-priced books that deal really adequately with the subjects in which the modern boy is most interested. The books that are to be included in the series will be those that have proved their merits by their large sale in their original and more costly edition, and the first three are thoroughly typical.

"The Romance of the Merchant Ship" tells the fascinating story of the evolution of the merchant ship from the earliest times. It shows how the mariners of ancient days slowly and laboriously developed their primitive craft as the result of hard-won experience. From the galleys of the Mediterranean we pass on to the ships of the Vikings in northern waters, and so by gradual stages the sailing ship grows before us until it reaches its full perfection in the clipper ship era. Then steam began to displace sail, and we are shown the marvellous development that has taken place since the first small steamship struggled across the Atlantic. The great liners of to-day and the wonderful engines that propel them are described in detail, and interesting descriptions are given of the less picturesque but equally important cargo ships, oil tankers, refrigerator ships and other vessels. The building, launching and fitting of a great ship are dealt with, and finally we are shown how a ship is navigated.

"The Book of Remarkable Machinery" covers an extraordinary amount of ground, and is full of interest for any mechanically-minded boy. The growth of the steam engine is dealt with in great detail, and an unusually lucid description is given of the steam turbine, concerning which the average boy's ideas are extremely vague. The operation of the internal combustion engine in all its varieties is made plain, and we are shown how this type of engine has made possible the development of the high-speed motor car and the aeroplane. From here we pass on to the machinery used in the production of iron and steel, and are introduced to the wonderful machine tools by the aid of which the engineer of to-day turns out work of almost incredible perfection and accuracy. The remaining sections of the book are devoted to the machinery employed in printing, and to a variety of less familiar but equally interesting mechanisms.

"The Boy Electrician" is a veritable storehouse of information for any boy who wishes to learn the principles of electricity by means of a series of experiments carried out at home. The construction of the necessary apparatus is fully described from the point of view of a boy whose supplies of materials are very limited, and who has few tools and little or no technical skill. This book is quite up to date, and forms an interesting and reliable guide to the mysteries of the electrical mechanisms that play such an important part in every-day life.

Each of these three volumes is lavishly illustrated with full-page plates and line drawings in the text. W.M.

"The Ancient Bridges of Mid and Eastern England"

By E. JERVOISE

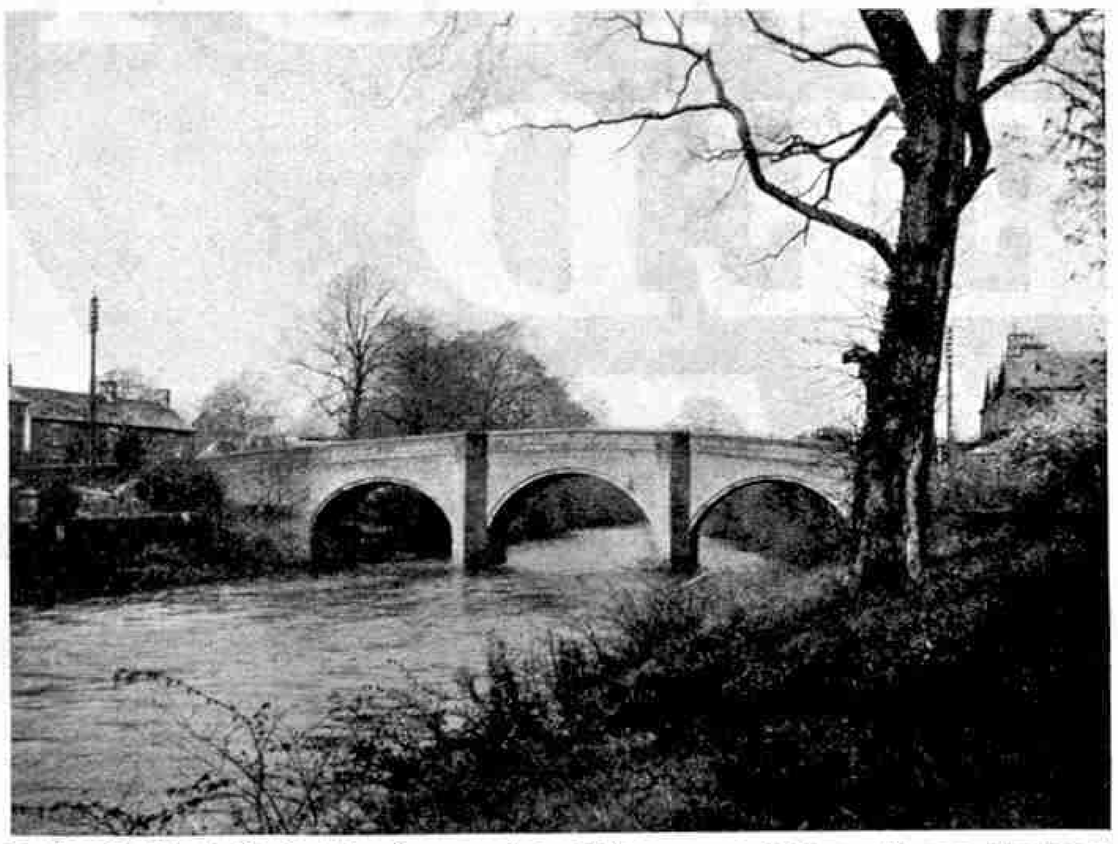
(Published by the Architectural Press. 5/6 net)

This is the third book dealing with English bridges written by Mr. Jervoise on behalf of the Society for the Protection of Ancient Buildings. The work is concerned mainly with bridges that might be threatened with road-widening schemes. It deals with the bridges in the eastern half of England bounded by the counties of Lancaster and York in the north, and by the River Thames in the south. The bridges of those rivers in the county of Warwick that flow westward to the river Severn will be the subject of a fourth volume dealing with Wales and Western England.

The book is written from first-hand experience, for the author has endeavoured, as far as possible, to visit the main crossings shown on a large-scale map published towards the end of the eighteenth century. He has gone to considerable trouble in compiling the historical notes, and has searched many records for his material.

Many of the bridges mentioned have happily been saved from destruction by road improvement, by the building of by-pass bridges. Baslow Bridge, in Derbyshire, of which we are able to reproduce an illustration, is one of these. It has three lofty arches spanning in all 99 feet, and is 12½ ft. in width. This bridge illustrates the fact that as early as the sixteenth century there were restrictions on the traffic that passed over bridges, for in the year 1500 it was determined that "no one henceforth shall lead or carry any millstones over the bridge under pain of 6s. 8d. to the lord for every pair of millstones so carried." It is interesting to note that this bridge was repaired during the reign of Queen Anne at a cost of £40.

The book, which is illustrated with half-tone plates showing eighty bridges, will be of great service to those interested in ancient bridges of the districts covered.



Baslow Bridge in Derbyshire, for carrying millstones over which one Thomas Harrison was fined 6s. 8d. in 1501. (From "Ancient Bridges" reviewed on this page.)

"Athletic Training for Men and Boys"

By F. A. M. WEBSTER and J. A. HEYS

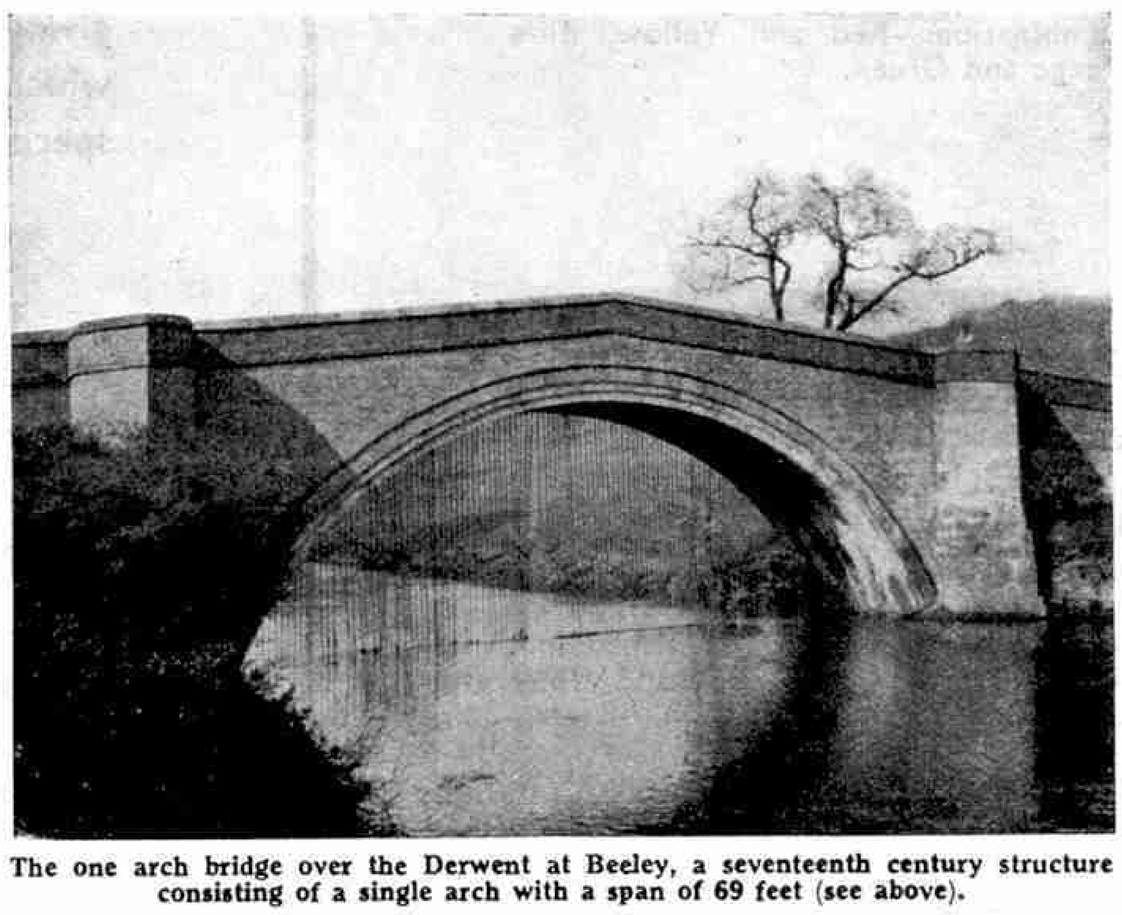
(J. F. Shaw & Co. Ltd. 5/– net)

The most notable feature of this book is its intensely practical nature. It aims to provide, through the medium of an exhaustive series of tables, a complete guide to training for the main athletic events, with special attention to the making of steady progress without reaching the point of staleness. There is no doubt that many promising athletes have failed in critical events as the result of pushing their training too far, and in particular of failing to "taper off" before the day of the contest. On this point the authors say: "We have not forgotten the many fine athletes who, through doing just a little too much in final preparation, have made the sad discovery, on the day of the big event, that they have left their running behind them on the training track."

The tables cover the ground minutely, dealing week by week with the course that should be followed during the three months' final training. Special attention is given to graduated effort. Quarter effort, for instance, represents the slow work done for stamina, and for learning new features of technique; half effort represents the speed at which the bulk of training is done; and three-quarter effort is designed to accustom the athlete to speed, and to test his ability to retain his form when running nearly flat out.

By following intelligently the general advice and the tabular details for each event an athlete should practically ensure the most rapid progress, together with freedom from the danger of over-exertion. The authors are very emphatic on the necessity for care in the athletic pursuits of boys, and they urge that masters should concentrate their attention on teaching their boys style and correct method, instead of urging them to strive for records. There is of course a great temptation to endeavour to secure school records, but such a policy is always likely to result in undue strain.

The book is excellently illustrated by a large number of well-chosen action photographs.



The one arch bridge over the Derwent at Beeley, a seventeenth century structure consisting of a single arch with a span of 69 feet (see above).

"The Inventor and his World"

By H. STAFFORD HATFIELD, Ph.D.

(Kegan Paul. 6/– net)

There has always been great popular interest in the wonderful achievements of inventive geniuses such as James Watt, Richard Trevithick, Sir Charles Parsons, T. A. Edison, and Marconi. We read eagerly the stories of their careers, and of how they overcame one obstacle after another that lay along the path to success: but until recently little effort has been made to understand how the mind of the inventor works. This is the problem that Dr. Hatfield has tackled in this book, and he begins by enquiring: "What is Invention?" This question is not easy to answer, in spite of its apparent simplicity. The author regards the act of invention as a flash of inspiration that solves a baffling problem. He looks upon the inventor as one who possesses special aptitude in mechanics, chemistry, or some other field of work, and who, when confronted with new problems, is able to see deeper into things than other men. To the mind of the inventor "comes a suggestion, a vision, of a new form; one, perhaps, which seems absurd; but scrutiny or experiment shows it to be the sought-for solution and remedy."

Dr. Hatfield then talks about inventors themselves. He describes them as "self-starters," or men who think and move for themselves even when very young; and he instances Edison as a typical example. The inquisitiveness and energy of lone inventors of this type have been more productive than the elaborate research organisations of many great manufacturing firms. The reason for this, says the author, is that "creative work is *over*-work . . . It needs sweating and worrying in the small hours of the night; it is mono-mania. The hope of fortune, the pressure of creditors, nay, even the battle with insufficient means and appliances, are the spurs that are needed."

In chapters that contain sound advice, emphasised by well-chosen stories, often amusing, of the experiences of inventors, the author examines the nature of successful inventions and the means of placing them on the market. The rest of the book consists chiefly of a survey of the fields open to inventors.

The book is full of interesting information, but contains one important error that we hope will be corrected in a future edition. According to the author, "Meccano arose out of the fact that a manufacturer of small stamped parts gave his children the strip from which the parts had been stamped to play with together with some small nuts and bolts." All readers of the recent series of articles on "*The Life Story of Meccano*" know that this is wrong, and that the idea of using strips and plates with equidistant holes came to Mr. Hornby by one of the very flashes of inspiration that are described by Dr. Hatfield as the essence of invention.

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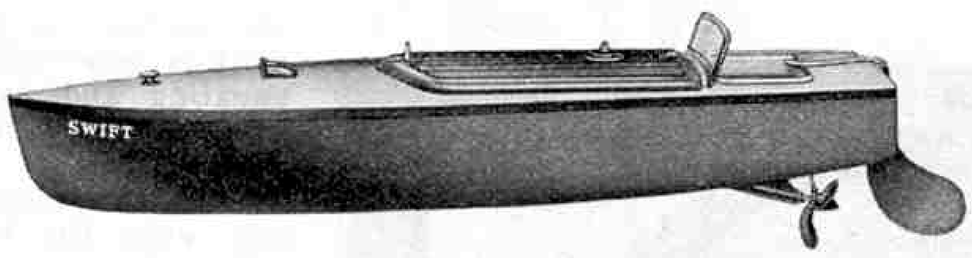

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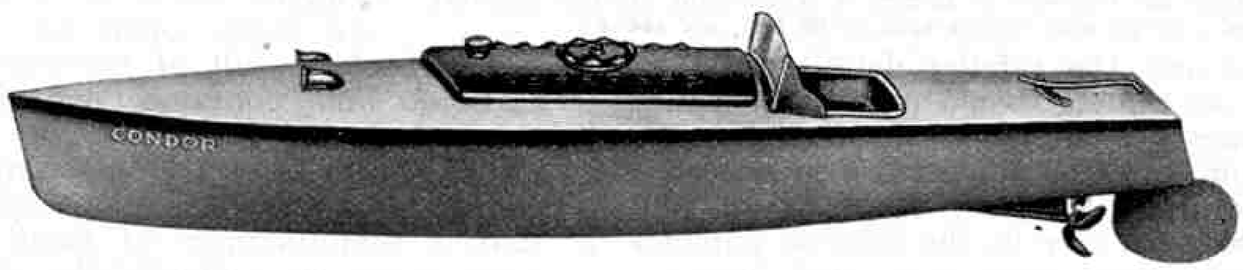

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Hornby Speed Boat No. 3 has already established itself as a great favourite. It will travel over 500 feet on one winding. Available with three different names and in three different colour combinations, as follows :—**"Condor"** (Red and Cream), **"Gannet"** (Blue and White), **"Curlew"** (Green and Ivory). Dimensions : Length, 16½ in. Beam, 3½ in.

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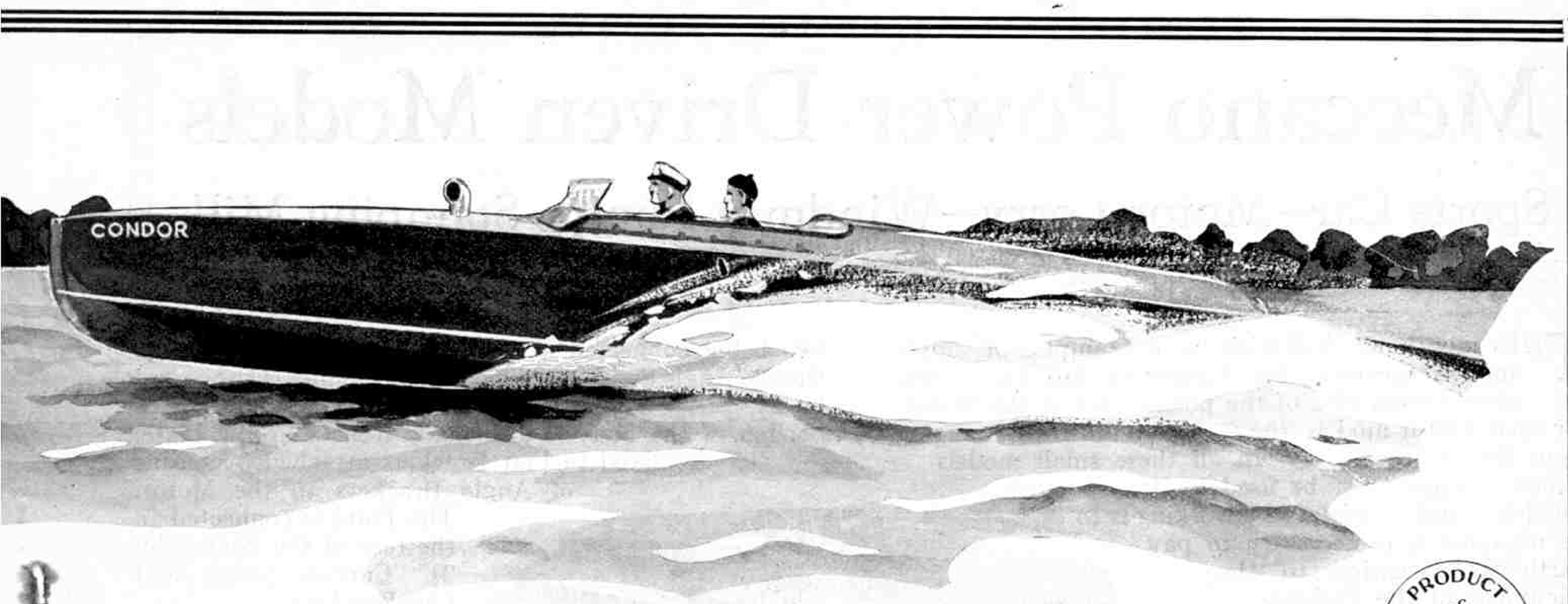
three different colour combi
and Jade Green and Ivory. D



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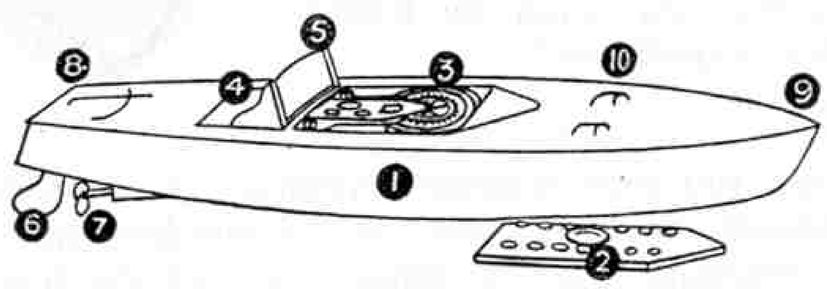


Hornby Speed Boat No. 3

(1) *Beautifully made hull, with watertight compartments. Available in a selection of rich colour combinations.*

(2) *Removable engine hatch giving access to motor.*

(3) *Powerful spring motor giving great length of run.*

(4) *Separate cockpit.*

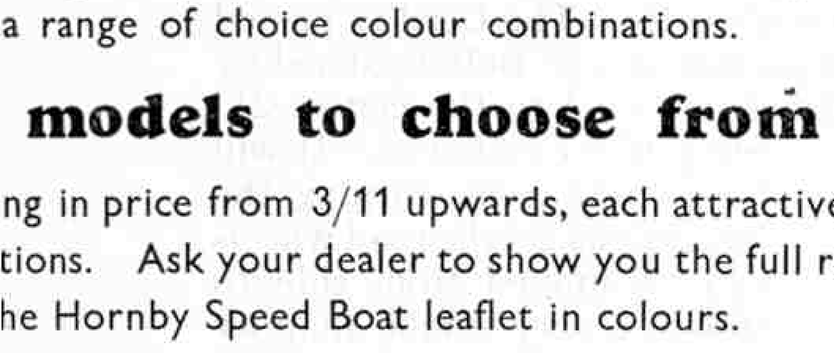
(5) *Real windscreen.*

(6) *Adjustable rudder with ratchet tiller rack.*

(7) *Scientifically-designed triple blade propeller giving maximum power and speed.*

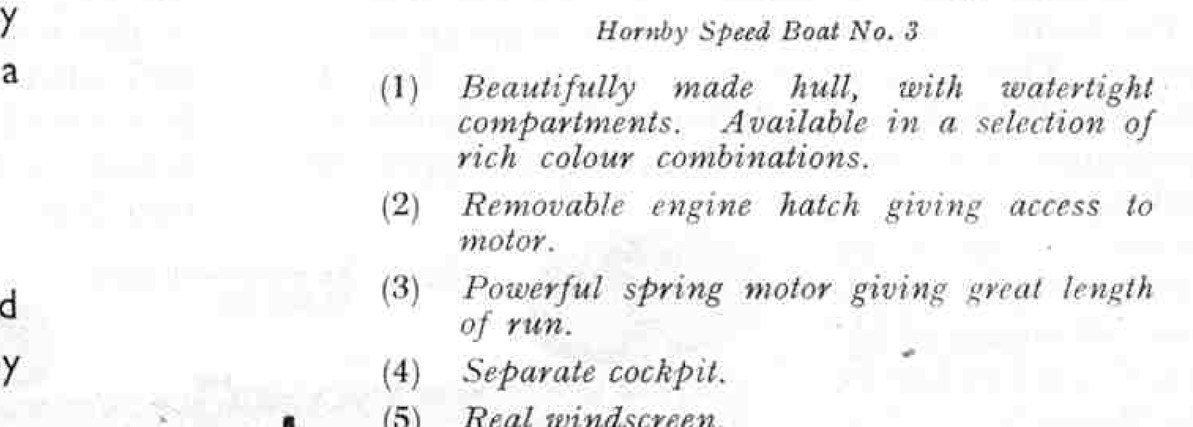
(8) *and* (9) *Bow and Stern flag sockets in Speed Boats Nos. 3 and 4.*

(10) *Ventilators.*



E BOAT No. 4. "VENTURE." PRICE 15/6

nby Limousine Speed Boat No. 4 is a magnificent l over 500 feet on one winding. Finished in combinations—Red and Cream, Blue and White, ory. Dimensions : Length, 16½ in. Beam, 3½ in.



HORNBY CABIN CRUISER No. 5. "VIKING." PRICE 16/6

The perfect design and handsome appearance of Hornby Cabin Cruiser Speed Boat No. 5 makes it a model of outstanding merit. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions : Length, 16½ in. Beam, 3½ in.

Meccano Power Driven Models

Sports Car—Motor Lorry—Windmill Pump—Stamping Mill

THIS month we deal with more examples of simple models incorporating Clockwork Motors. These give a good idea of the possibilities of the Motors for small Outfit models, the examples illustrated ranging from No. 00 to No. 2. In all these small models pulley systems must be used for transmitting the drive, and if satisfactory working is to be obtained it is necessary to pay particular attention to the alignment of the Pulleys. The loop of cord should not be made too tight or it will interfere with the smooth running of the model, but on the other hand if tied loosely it will not grip the Pulleys. The correct tension will soon be found after a little experiment.

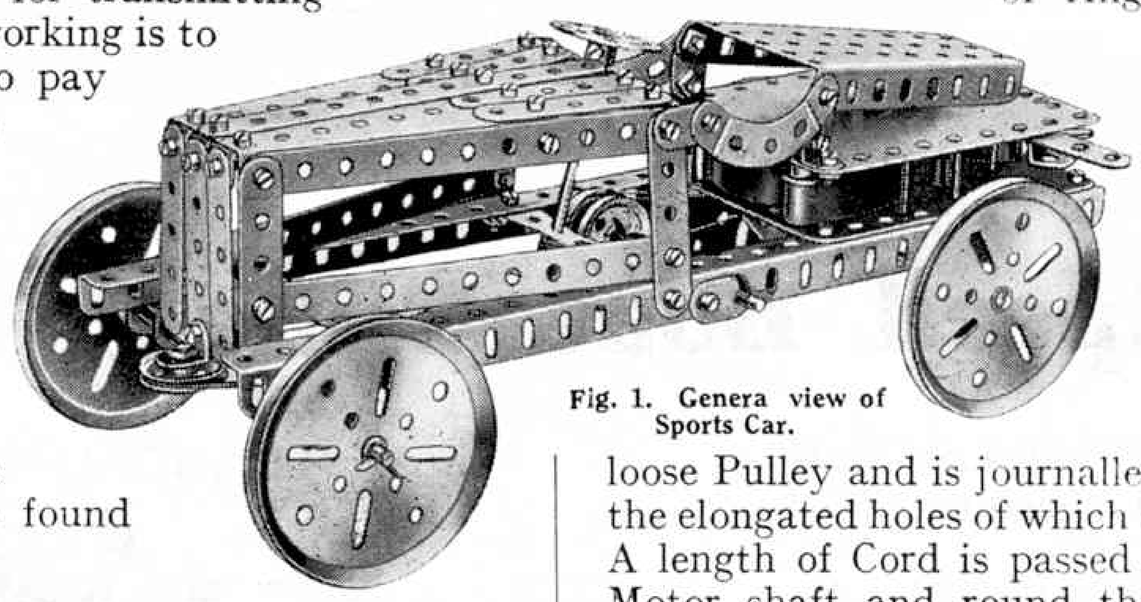


Fig. 1. Genera view of Sports Car.

Sports Car

Motor cars and road transport vehicles are extremely popular subjects with Meccano model-builders, and, of the many different types available for reproduction in miniature, the racing car probably heads the list in order of popularity. The two-seater car shown in Fig. 1, although built with only a No. 2 Outfit, has a distinctly sporty appearance, the long bonnet giving a suggestion of speed and power.

The chassis is made by spacing two $12\frac{1}{2}''$ Angle Girders apart by means of $3\frac{1}{2}''$ Strips and a No. 2 Clockwork Motor. The Motor is fitted at the rear of the chassis, and although this is contrary to actual practice it preserves the realistic appearance of the model. Two Flat Trunnions form journals for the rear axle that is held in place by Spring Clips, the 3" Pulleys being spaced away from the chassis. The front wheels are carried on $1\frac{1}{2}''$ Rods 3 (Fig. 2) forming the stub axles and held in Double Brackets. Each Double Bracket is fixed to a $1\frac{1}{2}''$ Strip by means of two Nuts on the shank of a Bolt that is passed through an Angle Bracket attached to the side Girder of the chassis.

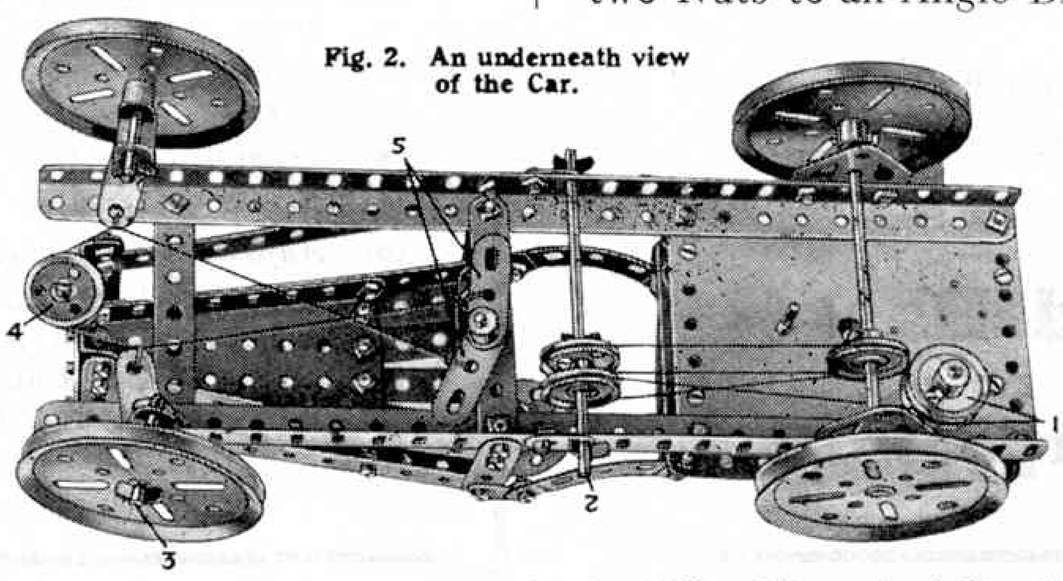


Fig. 2. An underneath view of the Car.

A Sector Plate is used for the bonnet, and the flanges are extended by $5\frac{1}{2}''$ Strips. A $5\frac{1}{2}''$ Strip is bolted along the centre of the plate and on each side of this are two $2\frac{1}{2}''$ Strips, the ends of which are connected by a $2\frac{1}{2}''$ Strip extended by a Flat Bracket. Angle Brackets connect the ends of this compound strip to the $5\frac{1}{2}''$ Strips attached to the side flanges of the Plate. The radiator is composed of vertical $2\frac{1}{2}''$ Strips. Three of these are bolted to the front of the Sector Plate by means of Angle Brackets, and one is placed at each side, these two being connected at their lower ends by a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip. The rear of the bonnet is supported by $2\frac{1}{2}''$ Strips bolted to the chassis Girders. The back portion of the body is also made from a Sector Plate, fixed to Flat Brackets attached by means of Angle Brackets to the Motor. The Plate is connected to the rear of the bonnet by $2\frac{1}{2}''$ Curved Strips and Flat Brackets.

Two 1" Fast Pulleys 1 are mounted on the Motor driving shaft and between them is clamped a $\frac{1}{2}''$ loose Pulley. A $4\frac{1}{2}''$ Rod 2 carries a 1" fast and a 1" loose Pulley and is journalled in the chassis side Girders, the elongated holes of which are covered by Flat Brackets. A length of Cord is passed round the $\frac{1}{2}''$ Pulley on the Motor shaft and round the two guide Pulleys before passing round the 1" Pulley on the rear axle.

The steering column is journalled in a Flat Bracket, bolted to the bonnet, and in one of the $3\frac{1}{2}''$ Strips spacing the $12\frac{1}{2}''$ Angle Girders of the chassis. On the lower end of the Rod are two Cranks 5, and Cord is tied to these, and also to the $1\frac{1}{2}''$ Strips extending to the Double Brackets that carry the stub axles. The Cord is passed round the Pulley 4 that is carried on a $\frac{3}{8}''$ Bolt attached by two Nuts to an Angle Bracket bolted to the centre $2\frac{1}{2}''$ Strip of the radiator. It will be seen that by turning the steering wheel the road wheels can be moved from side to side in a very similar manner to actual car steering gear.

Parts required for Sports Car :—5 of No. 2 ; 2 of No. 3 ; 12 of No. 5 ; 2 of No. 6a ; 2 of No. 8 ; 8 of No. 10 ; 2 of No. 11 ; 10 of No. 12 ; 1 of No. 15 ; 1 of No. 15a ; 1 of No. 16 ; 1 of No. 17 ; 1 of No. 18a ; 4 of No. 19b ; 4 of No. 22 ; 2 of No. 22a ; 1 of No. 23 ; 1 of No. 24 ; 9 of No. 35 ; 57 of No. 37 ; 3 of No. 37a ; 7 of No. 38 ; 1 of No. 40 ; 1 of No. 48 ; 2 of No. 54 ; 2 of No. 62 ; 2 of No. 90a ; 1 of No. 111c ; 2 of No. 126a ; 1 No. 2 Clockwork Motor.

Motor Lorry

The model shown in Fig. 3 incorporates a No. 1 Clockwork Motor built into the model so that it forms part of the "chassis" and holds the front and rear portions together. Readers designing new models should always bear in mind that, by using the Motor to form parts of the structure, a more realistic appearance is obtained than when the Motor is added after the model is complete. The Motor can very often be made to effect an economy in the use of certain parts required

elsewhere in the model. For small Outfit models the possibilities in this direction should not be overlooked.

In the model Motor Lorry the Clockwork Motor joins the bonnet to the body of the vehicle. A Sector Plate is fixed to the Motor and carries four 2½" Strips that support a similar Plate, and a 3½" Axle Rod forming the steering column is journalled between the two. The Rod carries at its upper end a Bush Wheel and at its lower extremity a 1" Pulley 3. A length of Cord is passed twice round the Pulley, and its ends are tied to a 2½"×½" Double Angle Strip pivoted by a Bolt and lock Nuts to the lower Sector Plate. The front axle is journalled in this Strip.

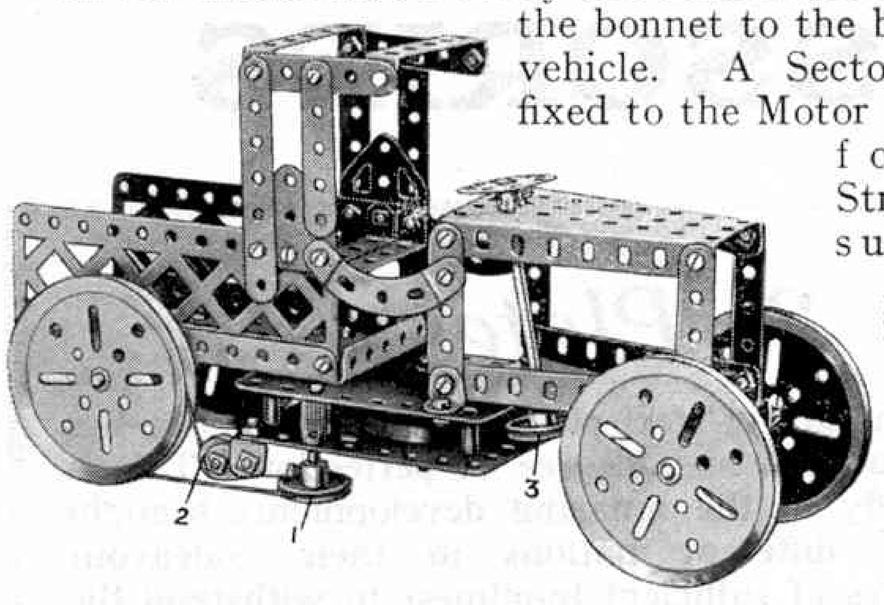


Fig. 3. Motor Lorry built with No. 1 Outfit.

The rear part of the model consists of a 5½"×2½" Flanged Plate bolted to the Motor with the flanges upward. To each side flange a 5½" Braced Girder is bolted, and these are spaced by two Double Angle Strips that represent the driver's seat. A cab is formed from a framework of Strips and Double Angle Strips. Two 2½" Curved Strips connect the front and the back sections to improve the appearance of the model and increase its rigidity.

A 2½"×½" Double Angle Strip is bolted beneath the Flanged Plate and carries the rear Axle Rod. The offside rear wheel receives the drive from a 1" Pulley 1 on the Motor driving shaft, and a ½" loose Pulley 2 is provided as a guide for the Cord. The Pulley is free to rotate on a ⅜" Bolt that is fixed by two Nuts to a Flat Bracket, which is bolted to an Angle Bracket on the Motor. It is important that the Pulley should be correctly placed, otherwise the Cord will not remain in the grooves of the driving and driven Pulleys.

Parts required for Motor Lorry :—2 of No. 2 ; 1 of No. 3 ; 8 of No. 5 ; 1 of No. 10 ; 2 of No. 12 ; 3 of No. 16 ; 4 of No. 19b ; 2 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 36 of No. 37 ; 4 of No. 37a ; 5 of No. 38 ; 1 of No. 40 ; 6 of No. 48a ; 1 of No. 52 ; 2 of No. 54 ; 2 of No. 90a ; 2 of No. 100 ; 2 of No. 111c ; 2 of No. 126a ; 1 No. 1 Clockwork Motor.

Windmill Pump

In certain country districts the water supply is obtained from deep wells from which it is pumped by wind power. A windmill is built directly above the well, and made to drive a pump that delivers the water to a reservoir or a tank from which it is drawn as required. Windmill pumps are utilised also for drainage purposes.

An interesting model of a wind-operated pump is shown in Fig. 4. The model incorporates a Clockwork Motor that can be made to rotate the sails and operate the pump in a most realistic manner. Four 12½" Strips are bolted to a 5½"×2½" Flanged Plate and are connected in pairs at their upper extremities by 2½" Strips. The two pairs of Strips are held together by 5½" Braced Girders to which they are attached by Angle Brackets. A 3½" Axle Rod is journalled in the centre holes of the 2½" Strips and carries a Bush Wheel and a 3" Pulley. Eight 5½" Strips are bolted to the Bush Wheel, and these are connected together in pairs by 2½" Strips as shown.

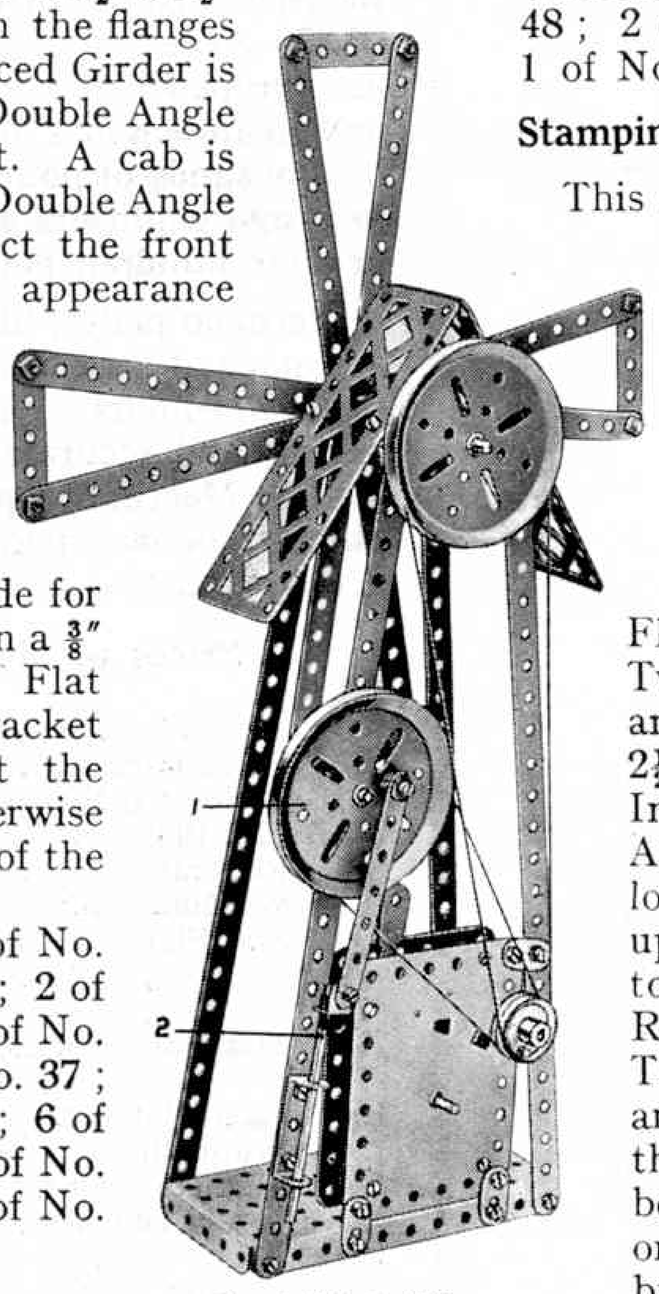


Fig. 4. Windmill Pump.

The No. 1 Clockwork Motor is mounted vertically on the base Plate and is fixed in place by Flat Brackets. Two 1" Pulleys are fixed on the driving shaft, and a loop of Cord round one of these drives a 3" Pulley Wheel on the Rod carrying the sails. The other one drives the Pulley 1, the Rod of which is journalled in one of the 12½" Strips and a ½" Reversed Angle Bracket. A ⅜" Bolt is attached to the Pulley by two Nuts and carries a 3½" Strip, on each side of which a Washer is placed. The Strip is pivoted at its other end to an Angle Bracket that is clamped between two Spring Clips on the Rod 2. This represents the pump, and slides in a 1½"×½" Double Angle Strip bolted to the 12½" Strip. As the Pulley 1 rotates the Rod 2 moves up and down in the Double Angle Strip.

Parts required for Windmill Pump :—4 of No. 1 ; 8 of No. 2 ; 1 of No. 3 ; 6 of No. 5 ; 3 of No. 10 ; 5 of No. 12 ; 2 of No. 16 ; 1 of No. 18a ; 2 of No. 19b ; 2 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 3 of No. 35 ; 37 of No. 37 ; 4 of No. 37a ; 3 of No. 38 ; 1 of No. 40 ; 1 of No. 48 ; 2 of No. 52 ; 2 of No. 100 ; 2 of No. 111c ; 1 of No. 125 ; 1 No. 1 Clockwork Motor.

Stamping Mill

This is a simple model that can be made with the parts contained in a No. OO Meccano Outfit, yet it is very fascinating in operation. When set in motion the stamp is raised and dropped in quick succession in a most realistic manner.

The construction of the model should be quite clear from Fig. 5. The Clockwork Motor is bolted to a 5½"×2½" Flanged Plate by means of two Flat Brackets. Two Flat Trunnions are bolted to the Plate, and carry 2½" Strips between which two 2½"×½" Double Angle Strips are secured. In the centre holes of these is a sliding 3½" Axle Rod fitted with two 1" Pulleys. The lower Pulley serves as the stamp, and the upper one is arranged so that it almost touches the rim of a Bush Wheel on a short Rod journalled in the Motor side plates. The Bush Wheel carries a Flat Bracket arranged in such a manner that it strikes the underside of the Pulley and raises it before letting it drop. A 1" Pulley carried on the same Rod as the Bush Wheel is driven by a rubber band or a length of Cord from a similar Pulley on the Motor driving shaft. The belt is crossed so that the wheel rotates in the proper direction.

Parts required for Stamping Mill :—2 of No. 5 ; 3 of No. 10 ; 1 of No. 16 ; 1 of No. 17 ; 4 of No. 22 ; 1 of No. 24 ; 13 of No. 37 ; 1 of No. 48a ; 1 of No. 52 ; 2 of No. 126a ; 1 No. 1 Clockwork Motor and 1 rubber band.

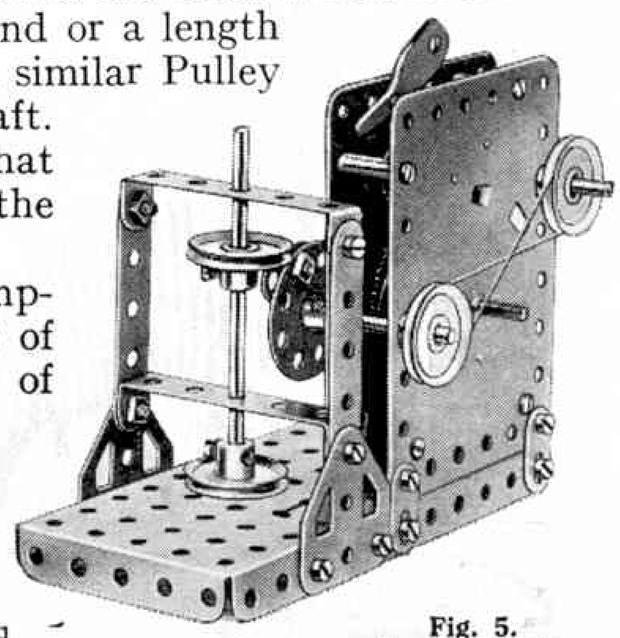
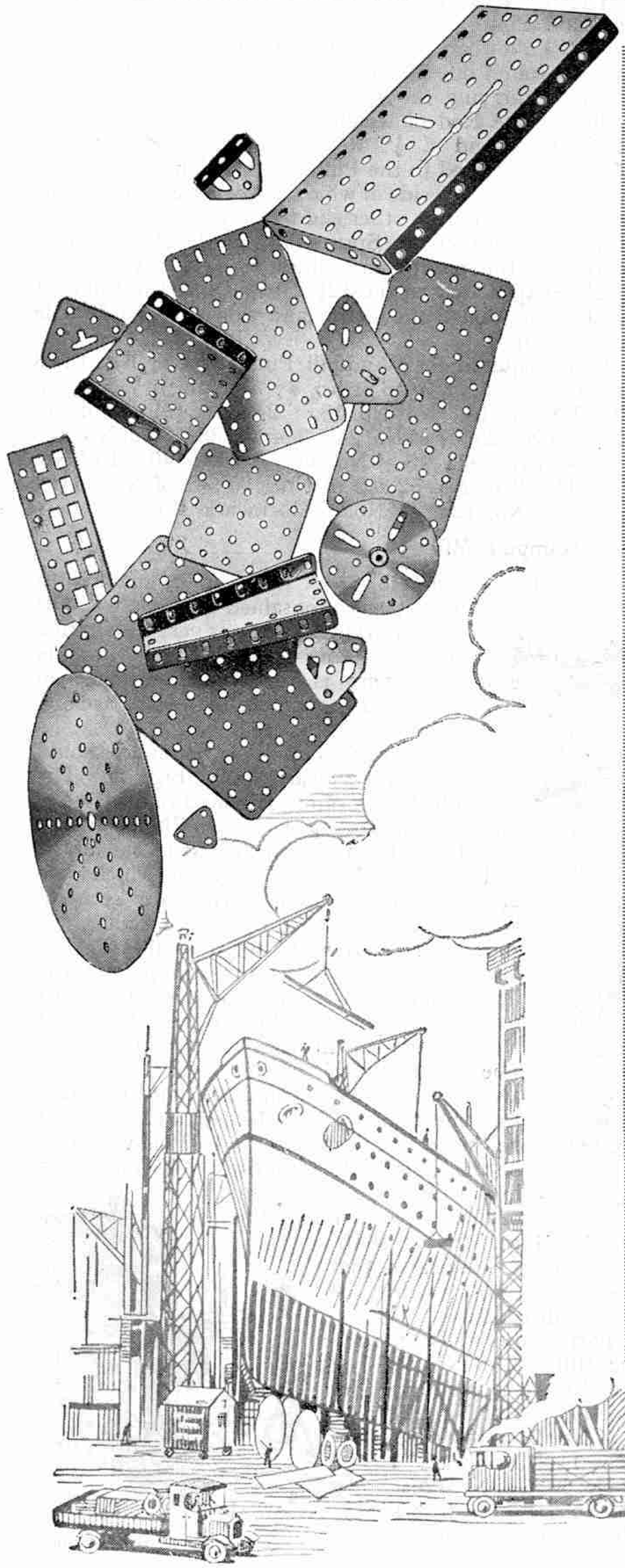


Fig. 5. Stamping Mill.

MECCANO
PARTS & ACCESSORIES



2. Plates

THE manufacture of steel plates in actual practice has reached a very high degree of perfection. This is due chiefly to the amazing developments brought about by the different nations in their endeavour to produce plates of sufficient toughness to withstand the ever-increasing power of enemy armour-piercing projectiles and high explosive shells. Fortunately, however, the new inventions and improved methods of preparing and rolling the metal thus brought to light are also being adapted to civil life.

Our modern banks and safe-deposits are provided with strong-rooms that defy bombs, burglars, fire and floods ; steel-encased motor-cars have been built to travel at speeds of 250 miles and over per hour ; all-metal aeroplanes have been propelled at more than 400 miles per hour ; and boilers and steam engines are now designed to withstand pressures of thousands of pounds per square inch, although not very long ago engineers dared not go beyond pressures of three or four hundred pounds !

Meccano plates, like their prototypes in real engineering, are made of the finest steel only. They are richly enamelled in bright colours—red and green—and the holes are punched cleanly and accurately. The holes are arranged according to the Meccano equidistant system, which enables the plates to be incorporated in any kind of model and used for a thousand and one different purposes.

Prices of Meccano Plates, Trunnions, etc.

No.			s.	d.
52.	Perforated Flanged Plates, $5\frac{1}{2}'' \times 2\frac{1}{2}''$, $\frac{1}{2}''$ Flanges...	each	0	5
52a.	Flat Plates, $5\frac{1}{2}'' \times 3\frac{1}{2}''$	„	0	5
53.	Perforated Flanged Plates, $3\frac{1}{2}'' \times 2\frac{1}{2}''$, $\frac{1}{2}''$ Flanges...	„	0	3
53a.	Flat Plates, $4\frac{1}{2}'' \times 2\frac{1}{2}''$	„	0	3
54.	Perforated Flanged Sector Plates	„	0	3
61.	Windmill Sails	4 for	0	6
70.	Flat Plates, $5\frac{1}{2}'' \times 2\frac{1}{2}''$	each	0	4
72.	„ „ $2\frac{1}{2}'' \times 2\frac{1}{2}''$	„	0	2
73.	„ „ $3'' \times 1\frac{1}{2}''$	2 for	0	3
76.	Triangular Plates, $2\frac{1}{2}''$	each	0	2
77.	„ „ $1''$	„	0	1
109.	Face Plates, $2\frac{1}{2}''$ diam.	„	0	4
126.	Trunnions, $1''$ deep, $\frac{1}{2}''$ flange	„	0	2
126a.	Flat Trunnions, $1\frac{1}{2}'' \times 1\frac{1}{2}''$	„	0	1
133.	Corner Brackets, $1\frac{1}{2}''$	„	0	1
133a.	„ „ $1''$	„	0	1
146.	Circular Plates, $6''$ diam.	„	1	0
146a.	„ „ $4''$ „	„	0	6
162.	Boiler, complete with Ends...	„	1	0
162a.	„ Ends	„	0	3
162b.	„ without Ends	„	0	6

Your dealer will be pleased to show you all the Meccano Parts. Ask him for a complete list.

MECCANO LIMITED
BINNS ROAD
LIVERPOOL 13

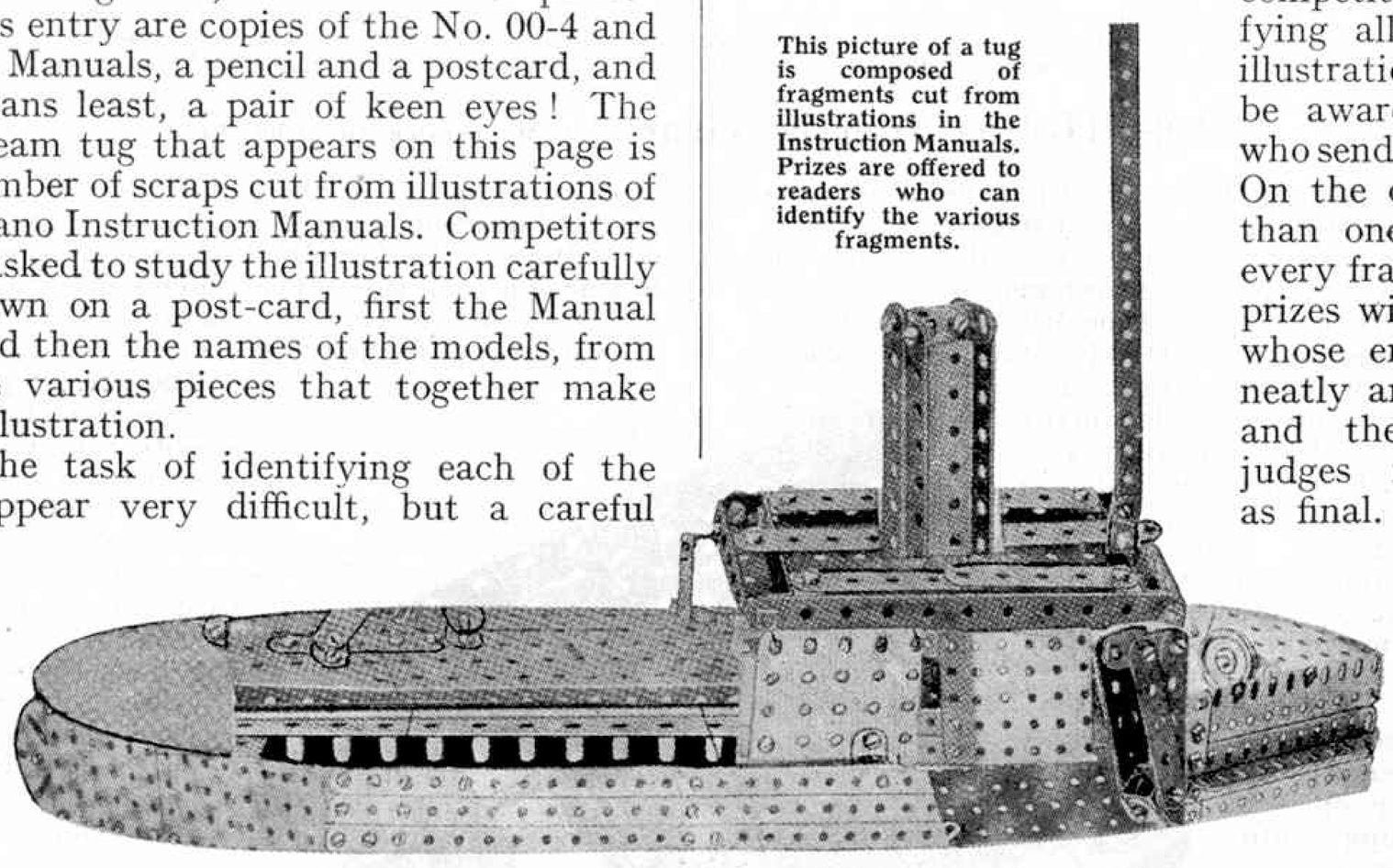
Do You Know Your Manuals?

Prizes for Keen-Eyed Readers

Every Meccano enthusiast who is familiar with the various models in the Instruction Manuals has a fine opportunity to win a big prize by entering this Contest. There is no model-building to do, and all that a competitor needs to prepare his entry are copies of the No. 00-4 and No. 5-7 Instruction Manuals, a pencil and a postcard, and last but by no means least, a pair of keen eyes! The illustration of a steam tug that appears on this page is made up from a number of scraps cut from illustrations of models in the Meccano Instruction Manuals. Competitors in this Contest are asked to study the illustration carefully and then write down on a post-card, first the Manual model numbers, and then the names of the models, from which are cut the various pieces that together make up the complete illustration.

At first sight the task of identifying each of the fragments may appear very difficult, but a careful inspection of the Manuals will soon enablecompetitors to "spot" from where quite a number of the fragments have been taken.

The nature of the Meccano parts shown in the various scraps will help considerably in solving their identity. For example, if the fragment contains part of a Coupling or Gear Wheel, it is at once obvious that it has been taken from an illustration of one of the larger models; while if the only parts shown are Strips and Pulleys, it is probable that the fragment has been cut from one of the simple models. The fragments are not necessarily printed in the same angular positions in the illustration on this page as they occupy in the Meccano Instruction Manuals.



This picture of a tug is composed of fragments cut from illustrations in the Instruction Manuals. Prizes are offered to readers who can identify the various fragments.

Competitors who cannot identify all the pieces should not be deterred from sending in their entries, for they may easily obtain one of the many prizes offered. If no competitor succeeds in identifying all the pieces in the illustration, the prizes will be awarded to the readers who send in the best attempts. On the other hand, if more than one competitor names every fragment correctly, the prizes will be given to those whose entries are the most neatly and clearly prepared, and the decision of the judges must be accepted as final.

The contest is open to readers living in any part of the world, and there is no age limit. Each competitor is allowed one attempt only.

The prizes to be awarded are as follows:—First: Meccano or Hornby goods value £3-3-0; Second: goods value £2-2-0; Third: goods value £1-1-0. Five prizes of goods value 10/–. Ten prizes of goods value 5/–.

The closing date for receipt of entries is Saturday, 30th September, 1933. Entries, which must be by post-card only, should be addressed "Lynx-Eye" Contest, Meccano Ltd., Binns Road, Liverpool 13. Prizewinners will be notified by letter as soon as possible after the closing date.

PRIZES FOR THE BEST SUGGESTIONS FOR MECCANO MODELS

This Contest is particularly suitable for a summer pastime, for in order to participate in it there is no necessity to stay indoors model-building, as in ordinary Meccano Contests.

During summer most boys indulge in long walks or cycling trips, and in the course of their travels have good opportunities for discovering interesting machines and other mechanical devices that would make ideal subjects for future Meccano models. It is, indeed, hardly possible to go anywhere without seeing something that could be reproduced realistically in Meccano. A country railway station will probably give ideas to an observant boy, or a peep at a village smithy will often provide a good suggestion, for here are often to be seen agricultural machines under repair. Those who live in big towns and sea-ports have even better opportunities for exploration, and a tour of the docks, railway goods yards, etc., will provide many splendid ideas.

In order to encourage readers to be keenly observant during their summer excursions we are offering prizes to those who discover the best and most original subjects for models in the course of their holidays. To qualify for these prizes competitors must first find an interesting subject suitable for construction in Meccano, and then write on a postcard the name of the suggested model, where they saw the original, and for what particular reason they selected it. Suggestions must be written on postcards only and sent to "Model Suggestions," Meccano Ltd., Binns Road, Liverpool 13.

The Contest is divided into two Sections:—A, for readers living in the British Isles, and B, for readers living Overseas. The following prizes will be awarded in each Section:—First: Meccano or Hornby goods value £1-1-0; Second: goods value 15/–; Third: goods value 10/6.

The competitor's full name and address must be written on the postcard together with letter A or B indicating the Section for which the entry is eligible. Entries for Section A must be posted in time to reach Liverpool on or before 31st July, 1933. The closing date for Section B is 30th September, 1933.

Suggestions Section

Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(290)—Hobbs Inertia Gear

(A. M. Johnston, Dunstable, Beds.)

The motor car gear-box and clutch at present in general use have many disadvantages, and although modern gear-boxes are vastly superior in design to the earlier types, they are still far from the ideal aimed at by designers of transmission systems. A considerable amount of skill is necessary on the part of the driver if the gear-box and clutch are to be used to the best advantage, and various schemes for dispensing with these units have occupied the attention of inventors for many years. Among these is the Constantinesco Torque Converter, which makes use of a swinging pendulum and lever principle for automatically adjusting the gear ratio between the engine and road wheels according to the load imposed upon them.

A device intended to minimise the use of the gear-box is the Daimler fluid flywheel. This increases the flexibility of the drive, and obviates the use of the clutch, except when changing gear. The self-changing epicyclic gear-boxes now coming into favour with a number of car manufacturers do much to simplify car control, but even these have certain disadvantages.

An ingenious invention intended to eliminate the clutch and gear-box entirely has been developed by Mr. H. F. Hobbs, an Australian engineer. His mechanism is automatic in operation, and adjusts the gear ratio according to the load imposed upon the road wheels. The results obtained from the mechanism are similar to those achieved by the Constantinesco Torque Converter, but are produced in a different manner. The Hobbs Inertia gear, as it is called, forms an excellent subject for a Meccano model, and has been well reproduced by A. M. Johnston, whose mechanism is illustrated on this page. Fig. 290 shows the complete arrangement, and to show its essential features more clearly an exploded view appears in Fig. 290a.

A casing for the mechanism is built up of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates bolted at each end to $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, but spaced by a washer on each securing Bolt. A $4\frac{1}{2}''$ Angle Girder is bolted along the lower edge of each end plate, and these are connected by $7\frac{1}{2}''$ Angle Girders.

The driving shaft 1 and the driven shaft 3 are arranged coaxially with a short intermediate shaft 2 (see Fig. 290a). The driving shaft corresponds to the engine crankshaft in actual practice, and is fitted with two Face Plates, bearings for the Rod being formed by the end plate of the frame and a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted between the side plates but spaced therefrom by washers. The 2" Rod 2 is inserted for a short distance in the boss of the end Face Plate on the Rod 1, but is free to rotate, and is also supported in a Double Angle Strip fitted between the side plates. The Rod carries a 50-teeth Gear, a Collar and a Face Plate. The driven Rod 3 is journalled in a Double Angle Strip and the $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Plate of the casing, and carries a Ratchet Wheel. It is also provided with a Pulley (shown in Fig. 290) fitted with a band brake, the purpose of which is described later.

The two Face Plates on the Rod 1 carry two $1\frac{1}{2}''$ Rods 4 that are free to rotate and are provided with $\frac{3}{4}''$ Pinions and Couplings. The Rods are inserted in the end transverse bores of the Couplings, and the latter each carry two collars firmly fixed, as shown, by means of $\frac{3}{8}''$ Bolts. The Couplings are spaced from the Face Plates by a Washer on each side. The Pinions mesh with the Gear Wheel 6, and when they are correctly placed the weights 5 should be arranged in exactly opposite positions before the Grub Screws are tightened up. The correct placing of the weights, in relation to each other, is most important if smooth running is to be obtained, as any inaccuracy will cause excessive vibration at high speeds. When they are correctly placed, and the Gear 6 is turned, they should move simultaneously towards the centre Rod and out again in unison.

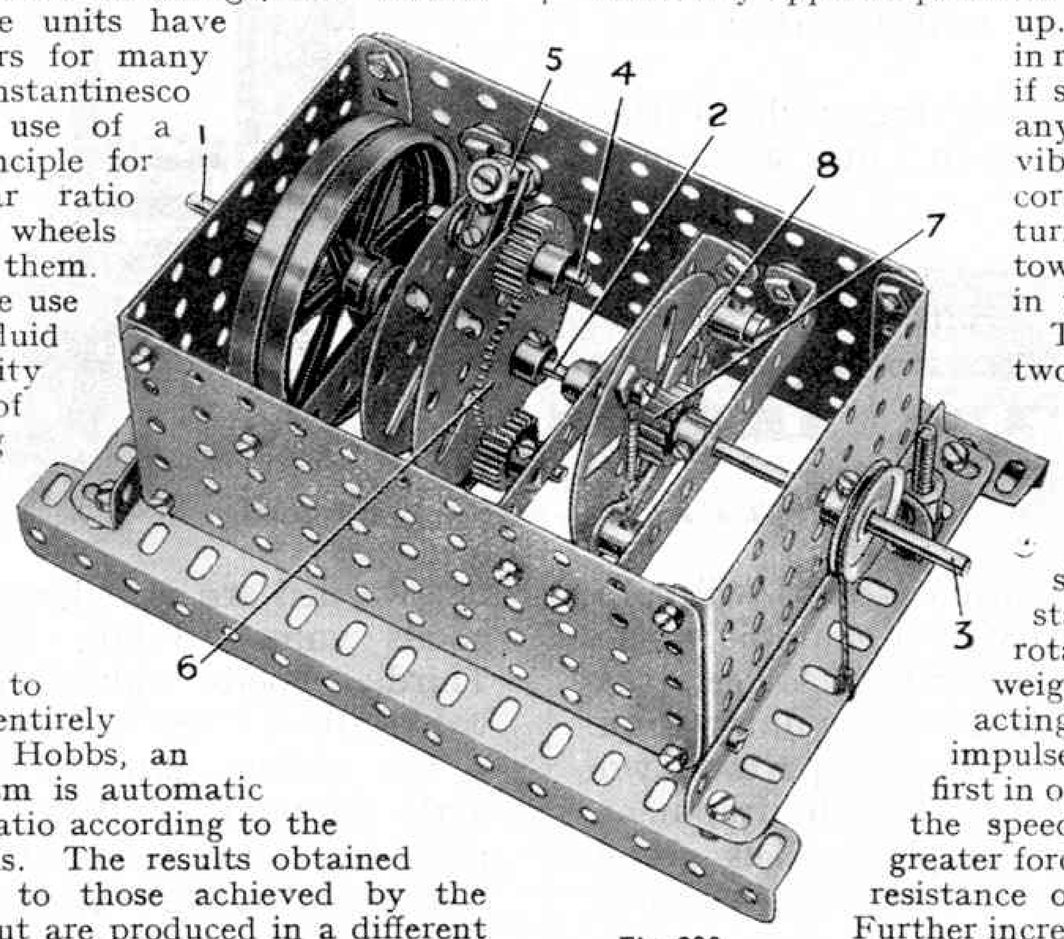


Fig. 290.

The Face Plate on the Rod 2 carries two Pawls 8, mounted on Pivot Bolts and held in constant engagement with the Ratchet Wheel 7 by means of Spring Cord. This arrangement serves as a freewheel and smooths out the drive. If the shaft 1 is rotated and the Gear 6 held stationary, the planet Pinions will rotate round the Gear, causing the weights 5 also to rotate. Centrifugal force acting on these weights imparts a series of impulses to the Gear 6, tending to turn it first in one direction and then in the other. As the speed of the driving shaft increases a greater force is exerted on the weights 5, and the resistance offered by the Gear 6 is overcome. Further increase in speed causes a tendency for the weights to remain in their outermost position, and when this stage is reached the device gives the equivalent of a "straight through" drive.

When the car is running under a heavy load, such as when climbing a steep hill, a lower gear is brought into operation automatically as soon as the resistance of the Gear 6 overcomes the centrifugal force acting on the weights 5. The gear ratio is always adjusted according to the relation between the load and the power of the engine. As an alternating movement is imparted to the Gear 6 at slow speeds, it is necessary to provide the freewheel already described. On the forward movement of the gear the Pawls engage the Ratchet Wheel, but on the backward stroke they trail idly over the Ratchet Teeth.

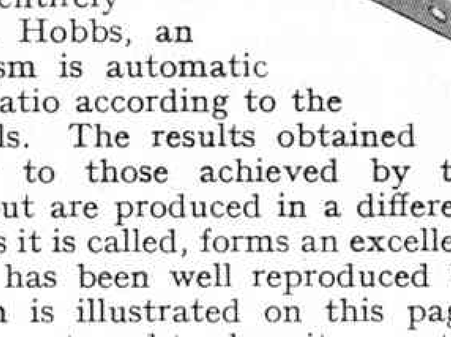


Fig. 290a.

For the purpose of demonstrating the working of the model when under load, a hand brake is fitted on the driven shaft. A length of cord is passed round a 1" Pulley on the Rod and tied at one end to the frame and at the other end to an Angle Bracket. The Bracket is passed over a vertical Screwed Rod and held down by a Threaded Boss, rotation of which varies the tension on the band. Thus the load on the driven shaft can be varied to represent actual conditions met with by a car.

In order to represent the momentum of the car a flywheel may be fitted on the Rod 3. This smooths off the impulses from the Ratchet Wheel 7.

(291)—Electric Roulette Wheel (D. Currie, Manchester)

An interesting variation of the usual form of Roulette Wheel is shown in Fig. 291. In this model eight electric bulbs are provided, each one being allotted a certain score value; and as the wheel is spun round the bulbs light up in turn. The winning number is indicated by the bulb remaining lit after the wheel has come to rest.

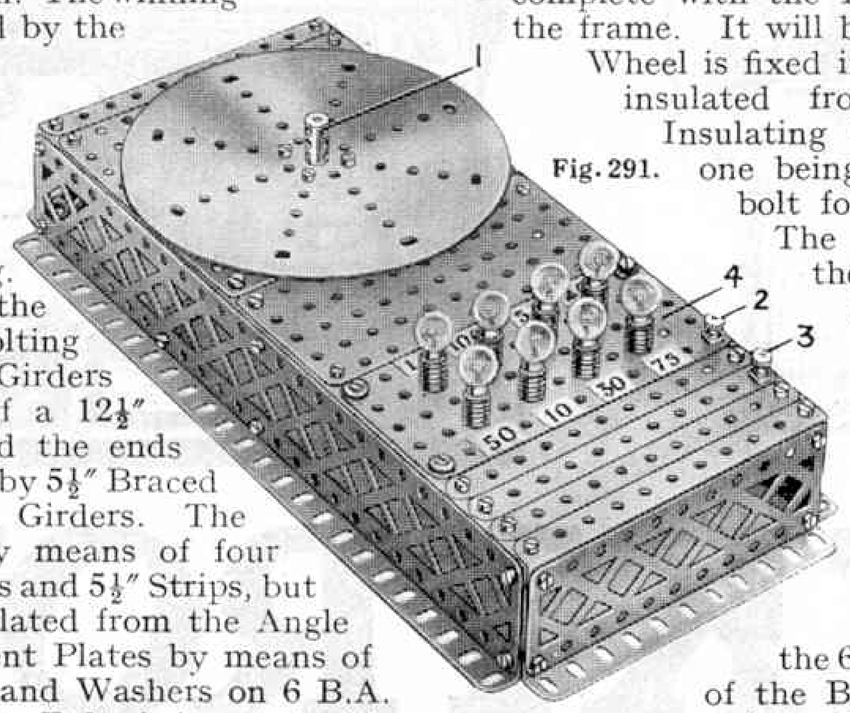


Fig. 291.

The external features of the model can be seen clearly from Fig. 291. Each side of the frame is made by bolting two 12½" Angle Girders along the edges of a 12½" Braced Girder, and the ends are joined together by 5½" Braced Girders and Angle Girders. The top is filled in by means of four 5½" × 2½" Flat Plates and 5½" Strips, but the Plate 4 is insulated from the Angle Girders and adjacent Plates by means of Insulating Bushes and Washers on 6 B.A. Bolts. One of these Bolts is inserted with the shank upward and carries a nut that is in metallic contact with the Plate, and also the Terminal 2. Eight Lamp Holders are placed in the positions shown and held down by 6 B.A. Bolts, each of which is insulated from the Plate by an Insulating Bush placed on the underside.

The wheel consists of two 6" diameter Circular Plates bolted to a Bush Wheel, two being used to give better running. The Rod, carrying the Bush Wheel carries also the Coupling 1, by means of which the Plates are spun, and is journalled in one of the Flat Plates and a 5½" × ½" Double Angle Strip. Fig. 291a shows the Double Angle Strip, complete with the Rod, removed from the frame. It will be seen that a Bush Wheel is fixed in the centre, but is insulated from the Strip by Insulating Washers, an extra one being provided on each bolt for spacing purposes. The remaining holes in the Bush Wheel are also provided with insulated 6 B.A. Bolts. A Double Arm Crank fixed on the Rod 7 is fitted with a Pendulum Connection 5 bent as shown to make contact with the heads of the 6 B.A. Bolts 6. Each of the Bolts is connected to one of the Lamps.

To connect up the model, one wire from the Accumulator goes to the Terminal 2, which makes contact with the Plate 4 only; and the other wire is fitted to the Terminal 3, which is in direct contact with the frame. The Rod 7, collects the current that passes along the Pendulum Connection 5 to one of the Bolts 6, and thence to one of the lamps.

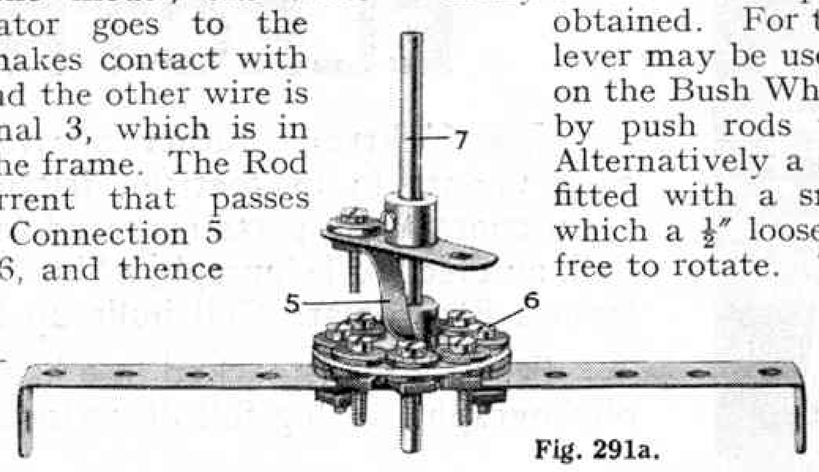


Fig. 291a.

(292)—Compact Reduction Gear

(A. Marrs, Dagenham, Essex)

Gear-boxes always provide plenty of scope for the designer, and the possibilities of Meccano parts in this connection are almost without limit. Reduction gearing plays a very important part in almost all power-driven models, especially those driven by the Meccano Electric Motors. These should always be allowed to "rev" at a fairly high speed, so that in all slow-moving models, and models requiring a powerful drive, reduction gearing is essential. An excellent example of the results achieved by the use of a large gear reduction ratio is to be found in the super model Traction Engine. In low gear this model has a total reduction ratio of 567 : 1 between the Motor and road wheels, and will haul with ease any boy of average weight.

In a previous issue of the "*M.M.*" we gave details of a remarkable gear-box giving a ratio of approximately 2½ million to 1 between driving and driven shafts, and housed in a frame measuring only 2½" × 2½" × 1½". The results were obtained by an ingenious arrangement of worm gearing. This device is scarcely of any practical use in Meccano model-building, however, although it serves to illustrate the possibilities of worm gearing. A very compact gear-box is shown in Fig. 292, and this will be found of utility in many instances where a fairly large reduction ratio is required. A ratio of 243 : 1 is provided between the driving shaft 1 and driven shaft 2, yet spur gearing is used throughout and only two shafts are necessary.

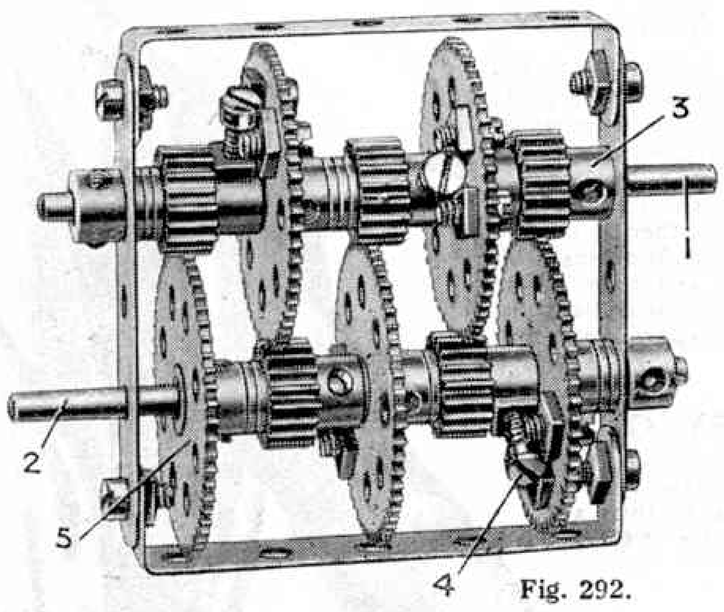


Fig. 292.

The Rod 1 carries a fixed Pinion 3 that engages a 57 teeth Gear loose on the Rod 2. The Gear is provided with two Bolts, the shanks of which are arranged on each side of the ⅜" Bolt 4. This Bolt is inserted in the boss of a ½" Pinion, but a nut prevents it gripping the Rod. In this way the Gear and Pinion rotate freely on the Rod as one unit. The Pinion engages a second 57 teeth Gear coupled in a similar manner to another ½" Pinion. The final gear 5 is fixed on its Rod, and a glance at the illustration will show that the drive can be taken from either end of the Rod 2. In like manner the Rod 1 may be driven from whichever end is most convenient in the model.

The framework of the gear-box, which is only of a simple form, may readily be replaced by the frame of almost any Meccano model such as a Traction Engine or Crane.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

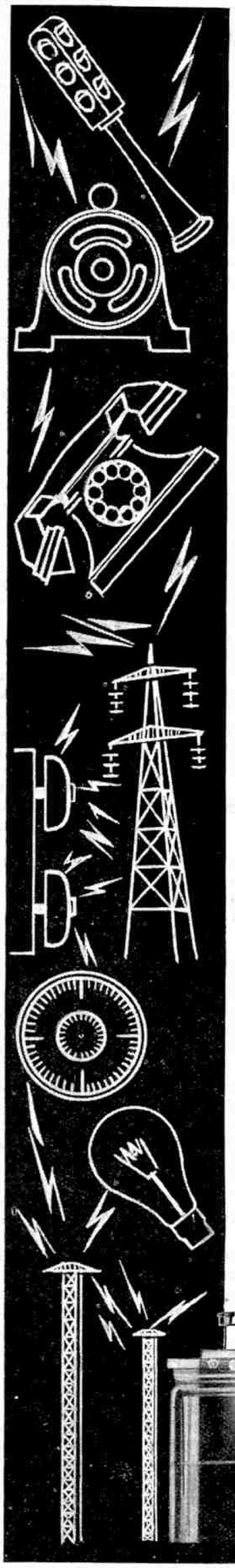
(M.163.) A Useful Cam.—P. W. Bradley (Kingsbury, N.W.9) suggests a method of making a cam that should be of use in a variety of different models requiring a reciprocating movement. As most readers are aware, a cam is utilised for converting rotary motion into a to-and-fro motion, the movement of the tappet being dependent on the shape of the cam. The type suggested by Bradley is used where a quick up-and-down movement of the tappet is required, with a slight dwell at the top of its stroke, and a longer period of dwell between each stroke. The valves of an internal combustion engine are operated in this manner.

The cam is made by bolting a 1" Corner Bracket to a Bush Wheel, so that it forms a projection on one side of the Wheel. As the Bush Wheel rotates this "bulge" raises the tappet once for every revolution, but by adding more Corner Brackets as many as four strokes per revolution can be obtained. For the tappet a pivoted lever may be used and made to rest on the Bush Wheel, being connected by push rods to the mechanism. Alternatively a sliding Rod may be fitted with a small Fork Piece in which a ½" loose Pulley or Collar is free to rotate. The Pulley bears on the rim of the Bush Wheel, and the Rod is made to slide in its bearings each time the Wheel mounts the Corner Bracket.

(M.164.) Illuminating Miniature Searchlights, Headlamps, etc.—The small pea lamps used in the Motor Car Lighting Set can be put to a number of useful purposes in Meccano models. L. Watson (Oxford) points out that one of these lamps can be inserted in the hole of a Chimney Adapter to form a very neat searchlight suitable for use in warships, etc. The lamp is held in place by a 6 B.A. fibre Washer at the back, and the complete searchlight is mounted in a Small Fork Piece. Headlamps and side-lamps can be made from large and small Flanged Wheels, the pea lamps being lightly gripped by grub screws in the Wheel bosses. The Wheels can be mounted on Screwed Rods, also inserted in the bosses.

(M.165.) Rack Quadrant for Hand Lever.—For brake levers and gear-change levers, etc., that require to be locked in different positions, the following device suggested by H. Chapman (Egham, Surrey) will be found useful. The lever consists of a pivoted Strip fitted with a sliding Eye Piece, the boss of which carries an Axle Rod sliding parallel to the Strip. The upper end of the Rod is free to slide in a Collar, and its lower end carries a Coupling to which a ½" Pinion is rigidly fixed. A Compression Spring normally holds the Pinion in engagement with a Rack Segment fixed to the frame, but when the Axle Rod is depressed the Pinion is released and the lever can be moved.

A neater method would be to substitute a Screwed Rod for the Axle Rod, thus dispensing with the Coupling.



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Model-Building Contest Results

By Frank Hornby

"X Series" Competition

The illustrations on this page show examples of models that can be made with the Meccano X Series Outfits. They were built by competitors in the " X Series " Model-Building Contest, and each has won a handsome prize for its builder. As this was the first competition organised specially for models built entirely from X Series parts, I did not expect a very large number of entries or a very high standard of work. I am glad to say, however, that I was quite surprised with the fine collection of models submitted, and with the ingenuity and clever manner in which the parts had been used. Some of the models sent in were obviously the work of inexperienced model-builders, but the majority were well constructed, and showed that really interesting models can be made from the X Series parts.

The list of principal prizewinners in the Contest is as follows.

Section A (for competitors under 10 years of age).

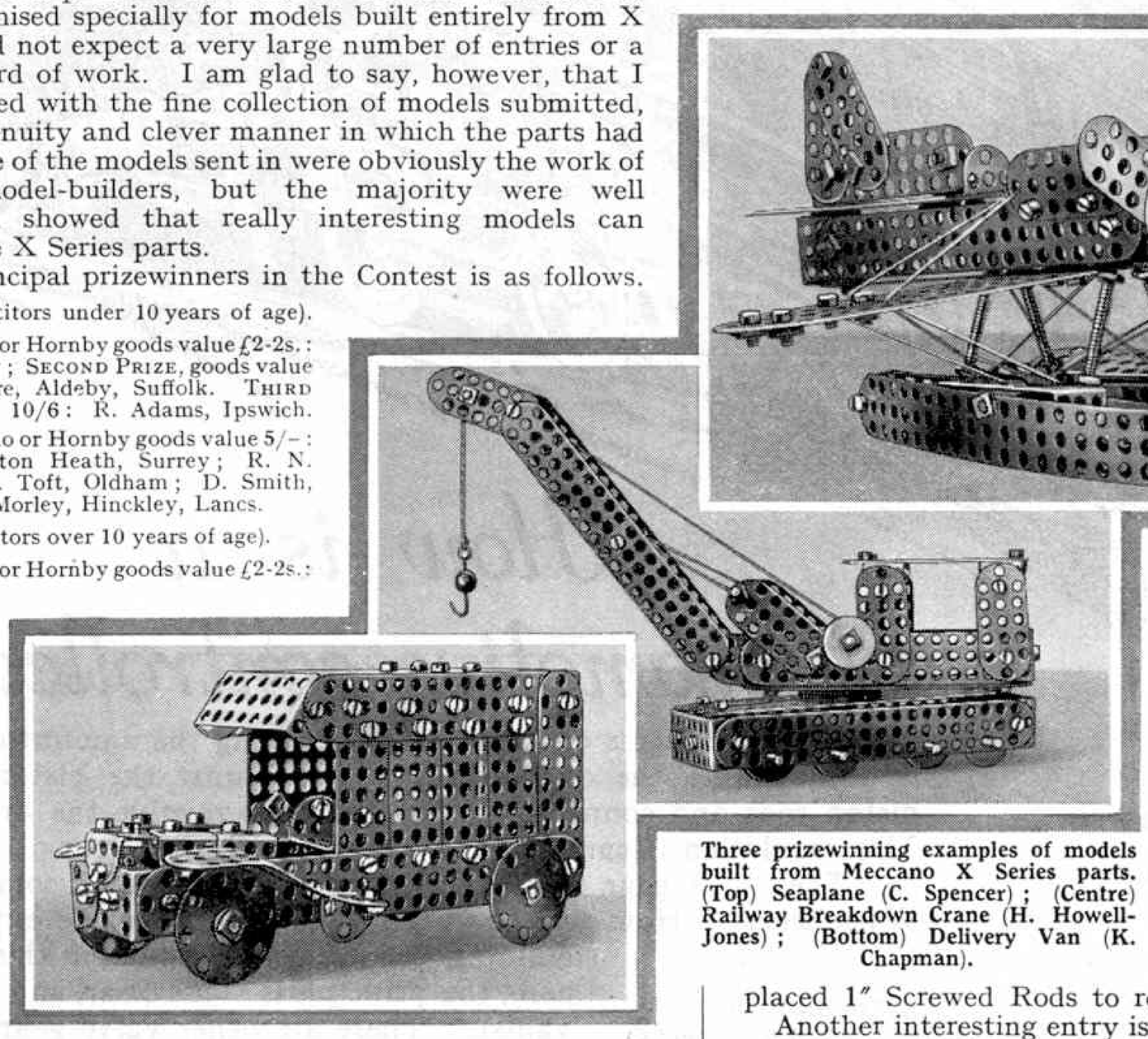
FIRST PRIZE, Meccano or Hornby goods value £2-2s.: B. George, Oswestry; SECOND PRIZE, goods value £1-1s.: P. le Fevre, Aldeby, Suffolk. THIRD PRIZE, goods value 10/6: R. Adams, Ipswich.

FIVE PRIZES of Meccano or Hornby goods value 5/-: N. Henton, Thornton Heath, Surrey; R. N. Atkins, Dover; G. Toft, Oldham; D. Smith, London, W.5; F. Morley, Hinckley, Lancs.

Section B (for competitors over 10 years of age).

FIRST PRIZE, Meccano or Hornby goods value £2-2s.: H. Howell-Jones, Gt. Crosby, Liverpool. SECOND PRIZE, goods value £1-1s.: K. Chapman, Poole, Dorset. THIRD PRIZE, goods value 10/6: C. Spencer, Warsash, Hants.

TEN PRIZES of Meccano or Hornby goods value 5/-: D. A. Limpus, Penryn, Cornwall; J. A. Kennett, Richmond, Surrey; H. Skinner, Deal, Kent; M. K. Smith, Clare Priory, Suffolk; H. Sorton, Salford; J. Foster, Tonbridge, Kent; H. Beard, Oldham; E. Parvin, Selby, Yorks.; Miss Doreen Daniel, Staunton, Glos.; E. B. Bottomley, Manchester.



Three prizewinning examples of models built from Meccano X Series parts. (Top) Seaplane (C. Spencer); (Centre) Railway Breakdown Crane (H. Howell-Jones); (Bottom) Delivery Van (K. Chapman).

Three of the chief prizewinning models are illustrated here. The first is a railway breakdown crane, which won First Prize for Hugh Howell-Jones of Liverpool. The illustration shows clearly the sound constructional details of the chassis and jib, and I think readers will agree that a very neat and realistic appearance has been obtained.

A model of a quite different type is the motor delivery van sent in by K. Chapman, of Poole, and a close examination of the accompanying illustration will reveal many clever applications of the X Series parts. C. Spencer, the winner of Third Prize, submitted the model seaplane illustrated. This is a splendid piece of work, and would have won a bigger prize but for the fact that in judging the models the judges had to take into consideration the ages of the competitors, and as Spencer is considerably older than Howell-Jones and Chapman, due allowance had to be made in allocating the prizes.

Eric Parvin sent a miniature model of a motor fire engine. It is fitted with a hose reel made from two ¾" Discs and a Screwed Rod, and the ladder is formed from two 4¼" Strips, between which are placed 1" Screwed Rods to represent the rungs.

Another interesting entry is a motor lorry and breakdown crane sent by Barrie George, Oswestry, who was awarded First Prize in Section A. Probably the most original model in this Section of the Contest is that which won Second Prize for Peter le Fevre. It is a miniature working lawn mower, and is mounted on wheels formed with two 1¼" and two ¾" Discs. The knife unit is represented by a Double Angle Strip lock-nutted on a 2½" Screwed Rod that forms the axle of the small Discs.

Third Prize in Section A was awarded for a portable crane.

"Familiar Home Objects" Competition. (Overseas Section)

As almost every home contains dozens of objects suitable for modelling in Meccano, I had looked forward to a record entry in this Contest, but unfortunately the number of models submitted did not come up to expectations. The entries that were received however, are quite interesting and I think, more original than those submitted in the Home Section. The principal prizes have been awarded as follows :—

FIRST PRIZE, Cheque for £3-3s.: T. C. Brook, Merrivale, Natal, S.A. SECOND PRIZE, Meccano or Hornby goods value £2-2s.: D. W. Johnston, Wellington, N.Z. THIRD PRIZE, goods value £1-1s.: E. Cauchi, Sliema, Malta.

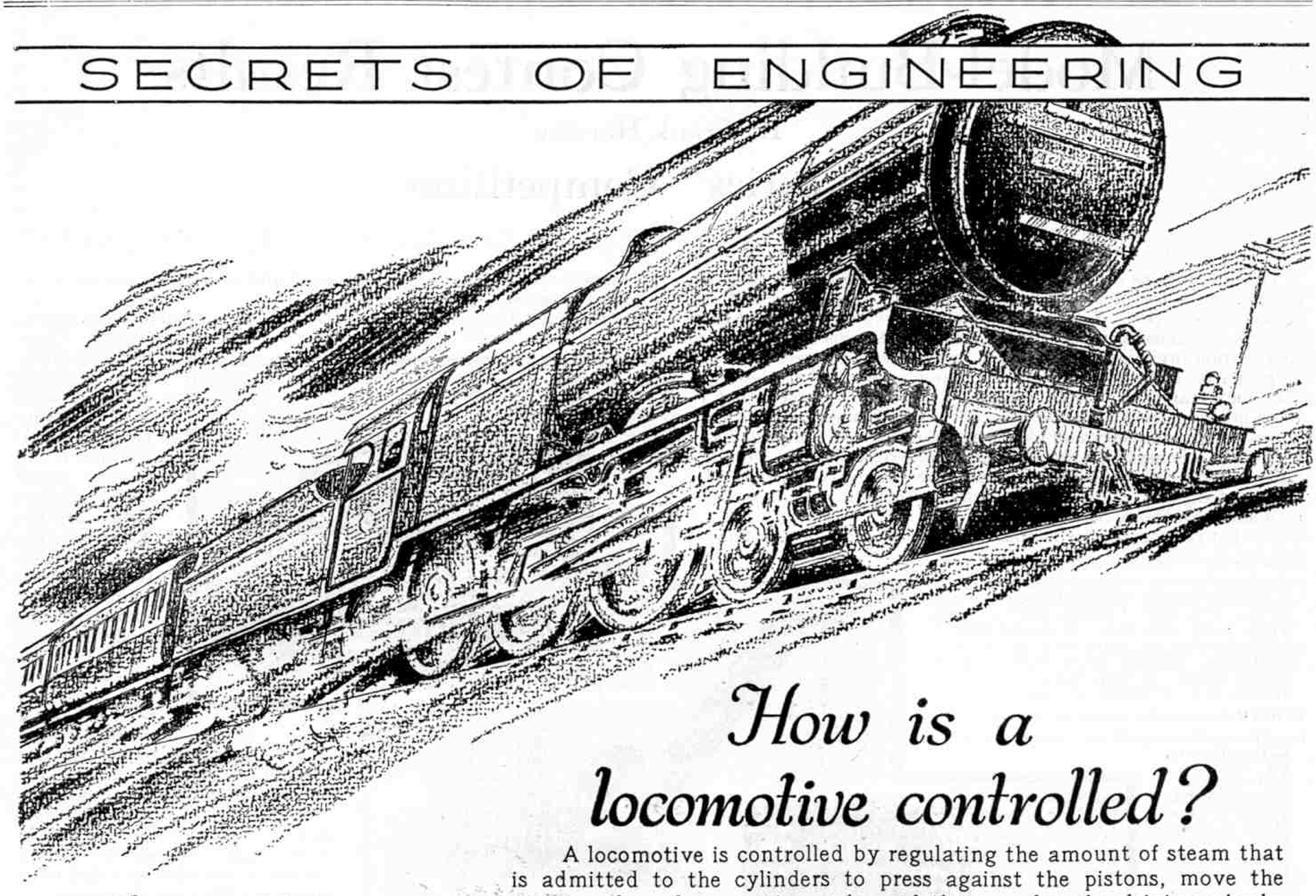
FIVE PRIZES of goods value 10/6: R. J. Ranikhetvala, Bombay; B. Hyde, Johannesburg, S.A.; J. McClymont, Toronto; D. Hill, Takaka, N.Z.; W. Scott, Quebec.

The most praiseworthy entry is a tiny model of a Chappel baby grand piano, sent by Thomas C. Brook, Natal, S. Africa. A remarkable feature of this entry is the fact that it will play four notes; Doh, Me, Soh, Doh, in the key of B flat! The " strings " are short pieces of Meccano Spring Cord secured in place by hooks also made from Spring Cord, and tensioned so as to produce the required notes. Each hammer is made from a piece of wood fastened to the end of a 3½" Strip, which is pivoted 2½" from one end. The other end of the Strip represents the key. The top of the piano opens sideways and is propped up by a Rod. The fall is hinged to open backward to allow the music rack to be pulled forward and opened up. Pedals are made from 1½" Strips, pivoted at their centres and fitted with damper rods. When the pedals are pressed the rods move up and down, but the dampers themselves are not fitted. Although the model is so small notes can be heard quite clearly when the keys are played.

D. W. Johnston submitted a replica of a bedroom complete with a bed and a full suite of furniture, all built entirely from Meccano parts. Edgar Cauchi's entry represents a drawing room complete with door, window, fireplace, chimney and electric lighting. The furniture includes a radio-gramophone, centre table, two armchairs, four small chairs, two flower-pot stands and six pictures. To make his model even more realistic Cauchi has added a mantel clock, mirror and a carpet!

Both these models are beautifully designed and contain many ingenious uses for Meccano parts. For example, the centre table in Cauchi's drawing room is made from a Hub Disc and a Circular Plate mounted on a short Rod, and the familiar out-curving legs are represented by small Curved Strips. Curved Strips are also made use of by D. W. Johnston to form the frame of a dressing mirror.

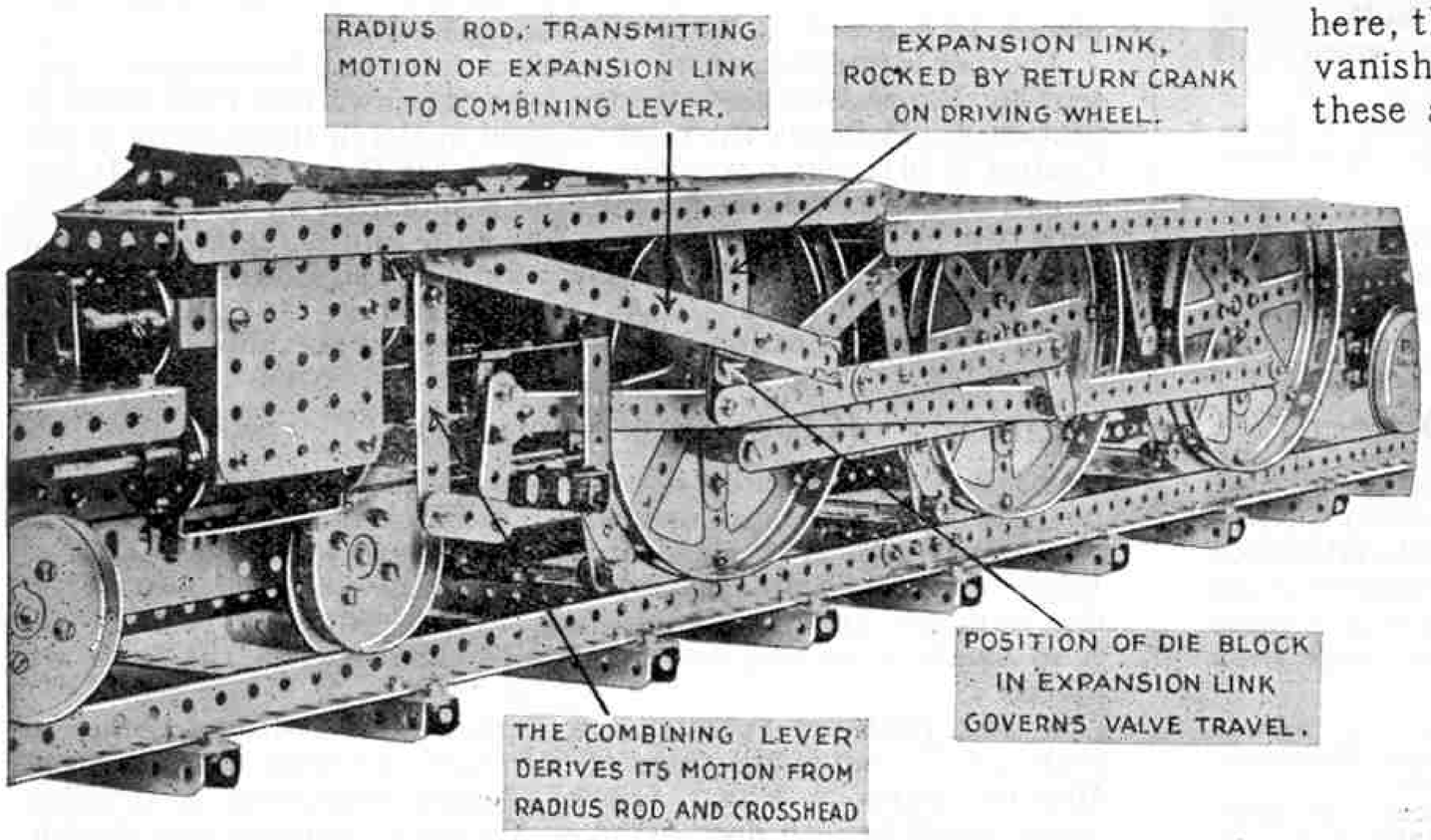
SECRETS OF ENGINEERING



How is a locomotive controlled?

A locomotive is controlled by regulating the amount of steam that is admitted to the cylinders to press against the pistons, move the piston rods and connecting rods, and thus revolve the driving wheels. This regulation is carried out by means of Valve Gear.

The valve gear most generally used in recent locomotives is the Walschaerts. How does it work? This is not easy to explain, but by building the Meccano model of this gear shown here, the principle is made clear, and all difficulties vanish. There are other valve gears in use, and these also may be reproduced in Meccano. All these models work—they can be manipulated so as to show the different valve movements for different conditions of working.



Here is the reason for the world-wide popularity of Meccano. It is not only fascinating to play with, but at the same time it teaches real engineering principles.

Meccano is real engineering in miniature—all the parts are miniatures of the corresponding parts in engineering practice. They are all standardised and interchangeable and can be used to make hundreds of different working models.

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Meccano Parts in Television Receiver

Another Scientific Application

FROM time to time we have described various applications of standard Meccano parts in the construction of scientific apparatus. This month we describe the manner in which Meccano has been used by a television experimenter, Mr. C. P. Garside, in the construction of a novel and highly successful portable televisor.

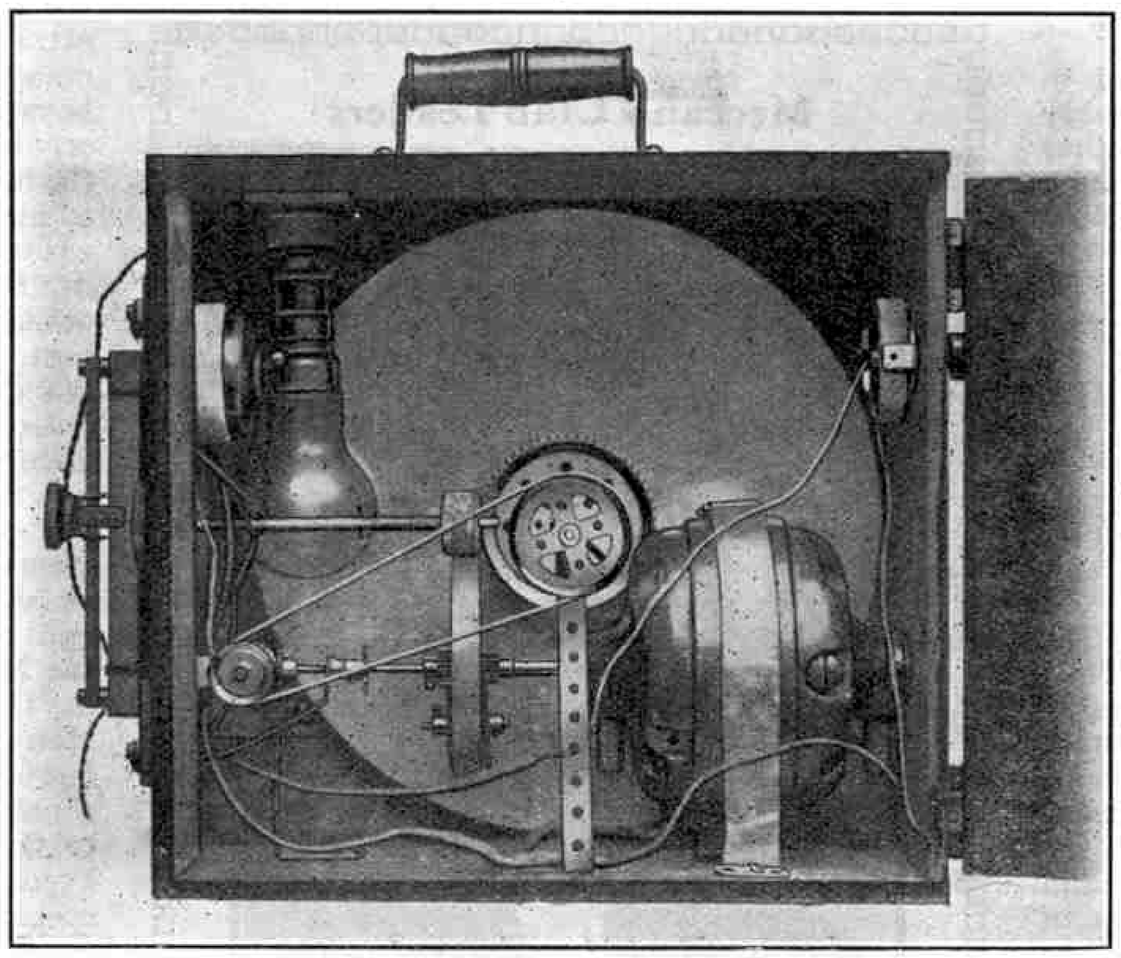
Readers who followed the series of articles on modern television that appeared in the "*M.M.*" for July, August, and October, 1929, will be familiar with the general principles of the transmission and reception of pictures by the Baird process, but for the benefit of new readers we give a brief outline of the method employed.

At the transmitting end the object to be televised is placed in front of a spirally-perforated disc, or scanning disc, which is rotated at high speed by means of an electric motor. A strong light is directed on to the object, and a light-sensitive electrical device known as a photo-electric cell is placed behind the disc. As the disc revolves, light reflected from the illuminated object passes through successive perforations to the photo-electric cell and is translated into electrical impulses that vary with changes in the intensity of the light. The movement of the disc ensures that every section of the object televised affects in turn the photo-electric cell, and the varying current thus produced is amplified and employed to modulate a wireless transmitting apparatus.

At the receiving end the "radio-television" signals are amplified and converted to low frequency by means of a powerful receiver. They are then fed to a neon gas glow lamp, causing this to emit light that varies in intensity in accordance with the variations in the intensity of the light reaching the photo-electric cell at the transmitter. The neon lamp is placed behind a spirally-perforated disc similar to the one used at the transmitter, both discs being run at exactly the same speed, and the light from the lamp passes through the perforations to reproduce the variations detected by the photo-electric cell. A lens is placed in front of the scanning disc at the receiving end, and when both transmitter and receiver are running in step the televised image may be viewed through the lens. This is of course only a very brief outline of the system. In practice it is necessary to incorporate apparatus for adjusting the speed of the motor driving the receiving scanning disc, and also for ensuring that the two discs are running "in phase" or in other words that each perforation in the receiving disc passes between the screen and the neon lamp at exactly the same time as the corresponding hole in the transmitting disc transmits light to the photo-electric cell.

In the latest pattern of Baird television receiver a special automatic device is employed to keep the disc running at the correct speed. In Mr. Garside's small receiver it was not possible to incorporate this special speed-synchronising device, and the speed of the scanning disc is therefore adjusted by hand by means of rheostats. The receiver incorporates an ingenious phasing gear working on the epicyclic differential principle.

Referring now to the illustration, which shows the interior of the receiver, the motor used for driving the scanning disc is seen mounted by means of a metal strap on the baseboard at the right-hand side of the case. The motor is of the fractional horse-power commercial type, and although a standard Meccano low-voltage Motor might have been employed, this probably would not have provided the power and uniform speed of the larger motor. The armature shaft of the motor carries a standard Meccano ½" Pinion that forms part of the phasing gear, which is assembled as follows. The main portion of the gear is a cast-iron disc, the edge of which can be seen in the photograph. This disc can be rotated at will by means of a small rubber wheel mounted on a shaft that projects outside the case and carries a suitable control knob on its outer end. A Meccano 2" Axle Rod is mounted freely in the face of the disc, and carries on one end a 57-teeth Gear Wheel that meshes with the ½" Pinion mounted on the armature shaft of the motor. A 50-teeth Gear Wheel is secured on the other end of the 2" Axle, and this meshes with a ¾" Pinion mounted on an Axle Rod that runs freely in the centre of the cast-iron disc, but is not connected to the armature shaft of the motor. When the cast-iron disc is rotated by means of the adjusting knob and rubber wheel, the teeth of the 57-teeth and 50-teeth Gear Wheels roll round their respective pinions and transmit a phasing action to the driven shaft without affecting the speed of the armature shaft of the motor. This method of bringing the scanning disc into step with the transmitter disc possesses the advantage that there is no need for the motor casing to be rotated, and thus complicated bearings and worm gearing are avoided.



The interior of Mr. C. P. Garside's Portable Televisor, showing the scanning disc, motor, and Neon lamp. The extensive use of Meccano parts will be noted.

The horizontal secondary shaft is supported in bearings constructed from Meccano Strips and Angle Brackets, which in turn are fixed to the case. A ⅞" Bevel is secured on the end of the secondary shaft, and this meshes with a further ⅞" Bevel mounted on a short Axle Rod. A 1" fast Pulley Wheel also is fixed on the Rod, and this is coupled to the scanning disc shaft by means of an endless belt composed of Spring Cord.

The scanning disc itself is composed of thin gauge aluminium sheet correctly perforated, and a Meccano 3" Sprocket Wheel is secured to the centre of the disc to provide a suitable bearing. The shaft on which the disc is mounted is supported in bearings composed of Meccano Strips, and a Meccano 2" Pulley Wheel is attached on the end of the shaft. This Pulley is coupled to the 1" Pulley previously mentioned by an endless Spring Cord belt.

A standard electric batten holder is fixed at the top of the case at the left-hand side to support the neon gas glow lamp, which can be seen in position in the illustration. A circular aperture is cut in the front of the case directly opposite the bulb of the neon lamp, and a magnifying lens is fitted so that the television image may be viewed at the front of the receiver.

The speed of the motor is controlled by two rheostats. A heavy-duty rheostat is mounted on the outside of the case at the left-hand side, and a small rotary-type rheostat is secured at the right-hand side.

To operate the instrument it is necessary to connect the neon lamp in the output circuit of a radio receiver, and to tune the receiver to the wavelength of the station from which the television signals are being transmitted. The motor is of course connected to the mains, or some other suitable source of current supply. The phasing gear and motor controls are then adjusted until the scanning disc is running in step and at the same speed as the disc at the transmitting station. The picture will then build up, and may be viewed through the magnifying lens at the front of the case.

Mr. Garside exhibited his televisor at an exhibition held by the Television Society some time ago, and it was found to give exceedingly good results.

Co-operation in Club Work

Now that members of clubs in Great Britain and other parts of the Northern Hemisphere are enjoying the pleasures of the outdoor season, it is interesting to recall that the winter is commencing in far-away New Zealand, Australia and South Africa. The difference in the seasons does not affect the keenness of club members, however, and everywhere both winter and summer programmes are entered upon with eager enthusiasm.

I always feel specially interested in overseas reports, for they invariably reveal a characteristic friendliness that also shows itself in co-operation between members of neighbouring clubs. Such co-operation is in the true spirit of the Guild, and its advantages are shown by the success of the Transvaal Meccano Clubs' Union, to which I referred in the January issue of the Magazine. This was formed only a few months ago, but every Meccano Club in the Transvaal has now joined it, and each derives strength from its association with similar organisations, whose members are animated by the same spirit.

The joint meetings arranged by the Union are particularly helpful. They have included enjoyable inter-club sports and a display at the Hobbies Exhibition organised by the "*Johannesburg Star*" on behalf of a poor children's holiday fund. These efforts have led to the formation of many firm friendships and also have shown that the members of the Guild are inspired by the desire to be of service to others. Those responsible for the formation and conduct of the Union are to be congratulated on their splendid achievements.

The most recent proposal of the Union is to organise model-building championship contests and every member is sure to make a special effort to win the honour of being the champion model-builder of his age-group. I am glad to see that there also will be a club championship, for the building of the necessary series of models for entry in this will encourage members to work together for the common good, and so help to achieve one of the most important aims of the Meccano Guild.

Guild Progress in Canada

Encouraging news comes also from Canada, where the Guild and club movement is steadily but surely securing a firm hold, as the reports appearing on the Club Notes page of recent issues show. Active new clubs have been established in Montreal, Winnipeg and Regina, and the officials and members of these have arranged attractive programmes. Models built by members have been displayed at Exhibitions organised by the clubs themselves, and also at special meetings of other organisations. These have aroused widespread interest in their activities, and a bright future seems to be in store for Meccano clubs in Canada.

Meccano Club Leaders

No. 66. Mr. J. W. Watkins

Mr. J. W. Watkins is Leader of Abington M.C. He has been in charge of the club's activities since its foundation, and under his Leadership great progress has been made, the energy and skill of officials and members having been favourably noticed in the local press.

Recent Exhibition Successes

The winter sessions of 1932–33 were remarkable for the increase in the number of Exhibitions organised by Meccano clubs. Undoubtedly these were even more successful than similar functions held in previous years, for they attracted larger attendances and received favourable notices from many distinguished quarters.

One particularly gratifying feature of the Exhibitions was their value in attracting new members. Officials of many clubs wrote to tell me that Meccano boys who had seen the displays they had organised expressed a wish to share in the interests of club life and were enrolled as members. In one instance the Leader wrote on the very day of the Exhibition itself to ask me to send Guild leaflets and other recruiting literature by return of post, explaining that he had been inundated with requests to join the club.

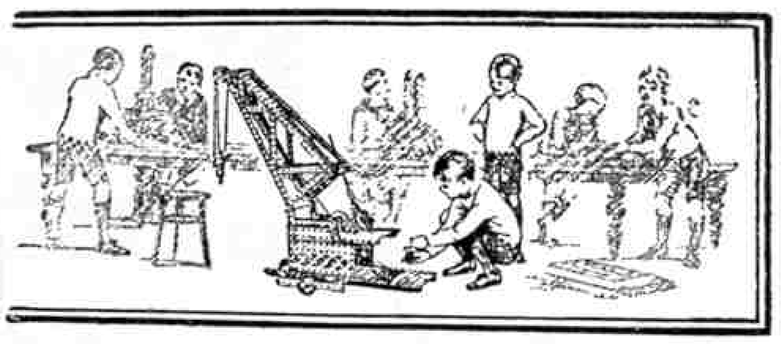
Undoubtedly the success of the Exhibitions of the past winter season was due to careful preparation. Guided by previous experience, officials and members spared no effort to make them as varied and attractive as possible, and also to make them known among the Meccano boys and others interested in the work of the Meccano Guild. Many ingenious methods were thought out with these aims in view. For instance, a novel scheme that contributed largely to the success of the Exhibition of the Plymouth M.C. was the inclusion of a special Exhibition Supplement with the issue of "*The Gearbox*," the official organ of the club, that was published shortly before the date of the display. This Supplement consisted of four pages inserted in the middle of the issue and printed on pink paper, and gave full details of the Exhibition itself, together with a plan of the room and a brief description of the chief features of each stall. The information it contained undoubtedly was of the greatest assistance to visitors, while the manner in which it was conveyed helped them to form a good opinion of the manner in which the club is organised, and of the capabilities of Meccano boys generally. In addition, the wide circulation of the issue of "*The Gearbox*" containing the Supplement stimulated interest in the Exhibition.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places and boys interested in becoming members should communicate with the promoters whose names and addresses are given below :—

HENGOED—L. Wright, "Elmsleigh," Pengam, Hengoed, Glam.
LONDON—Ernest Henderson, 59, Weston Park, Crouch End, N.8.
LONDON—V. G. Brabham, 61, First Avenue, Walthamstow, E.17.
NORTHWOOD—A. G. Hawes, Woodfield, Eastbury Avenue.
ROMFORD—Douglas Whipps, 23, George Street.

CLUB NOTES



St. Peter and St. John's (Exeter) M.C.—Mr. J. Blaker, secretary for many years is now Joint Manager of the club with Mr. M. C. Hodder. A board of directors is elected from members, and is largely responsible for the conduct of the club. Splendid model-building schemes are in operation. The original Workshop model has been converted into a model Power Station, and a new Workshop model is in process of construction. Other activities include the erection of an astronomical observatory modelled on that at Sidmouth, a Gantry Station and an Arc Lamp. Weekly lectures by Mr. Hodder form a new feature, the subjects of the earliest of these being "*The Early Days of Flying*," and "*Climbing Mont Blanc*." Club roll: 31. *Secretary:* D. Legg, 25, Chute Street, Exeter.

Sid Vale M.C.—In a splendid series of Model-building Contests members have entered Lorries, Aeroplanes, Racing Cars and Guns, and models of electrical subjects. Parents and friends were invited to a mock court which was acted for them, and a very enjoyable evening was spent. Other events have included a paperchase and a Social Evening. Club roll: 25 *Secretary:* R. Gliddon, Sheffield House, Sidmouth.

Greenford M.C.—All sections have been very active, especially the one making electrical apparatus. A Speed Boat section is arousing great enthusiasm among members and other important features of the outdoor season are cricket and cycling. More members are required, and the secretary will be pleased to receive applications. Club roll: 20. *Secretary:* R. Wynne, 80, Costons Lane, Greenford.

Chertsey M.C.—All meetings include fifteen minutes devoted to games and members who transgress rules are not allowed to take part. Several members are excellent boxers, and spirited displays are given on Boxing Evenings. In a novel event on a Surprise Evening, members present drew topics from a hat and were required to make a joke about it; in some cases the task proved to be more difficult than making a speech! A series of electrical demonstrations has included talks on the Shocking Coil and Wireless Receivers. The demonstration of the working of the Shocking Coil was highly appreciated by those taking part! Club roll: 14. *Secretary:* V. Brown, Arbon Grove Cottage, Lyne, Chertsey.

Laindon M.C.—The construction of girders from Meccano parts and the building of models containing no more than 30 parts, excluding nuts and bolts, have been the chief recent activities. A demonstration was given by Mr. J. P. Tourle, Leader of the club, on the working of wireless receiving sets and special meetings are to be devoted to this subject. Club roll: 19. *Secretary:* A. G. L. Schofield, "Highfield," Inverness Road, Laindon.

Hornsea.—Regular cricket practice and games are being arranged as the chief summer recreation. All sections of the club continue to hold interesting meetings for Model-building, and Lectures illustrated by lantern slides and cinema films. A visit to the gasworks was made specially interesting by means of chemical experiments, and outdoor meetings have included a picnic and cycle run of which an interesting record was made by means of a cine camera. Club roll: 85. *Leader:* Mr. R. W. Shooter, Eastgate, Hornsea.

Gatehouse M.C.—A splendid Meccano model and Hornby Train display has been held. A scene entitled "*The Ghost Train*" was enacted on the model railway, the incidents in this including a realistic accident. The Meccano section represented an Aerodrome, complete with aeroplanes of various types. This was lighted electrically and a searchlight was employed for night work. A Fretwork section, Waxworks, and Art Gallery added to the attractions. Lantern lectures have included one on "*East Anglia*" by Mr. F. E. Bolt, Leader of the club. Club roll: 12. *Secretary:* S. E. Wood, Gate House, Ingatestone.

Wembley M.C.—Joint meetings have been held with the Harlesden Methodist M.C., at one of which a lantern lecture on "*Bourneville*" was given, the slides being kindly loaned by Cadbury Bros. Ltd. Other meetings have been devoted to woodwork and to the preparation of models for the club's exhibition. Mr. G. B. Weightman, Leader of the Wembley and Harlesden Methodist clubs, unfortunately is unable to spare time for the meetings of both clubs and would be pleased to hear of a new Leader for the Wembley M.C. Club roll: 20. *Secretary:* Eric Burns, 31, Oakington Manor Drive, Wembley Hill, Middlesex.

St. Georges (Edinburgh) M.C.—A recent event of special interest was a talk on the "*Poetry of Engines*" by the Rev. J. B. Logan, M.A., B.D., S.T.M. A special feature recently has been made of visits and these have included inspections of the Fire Station, Police Headquarters, and the Headquarters of the B.B.C. in Edinburgh, while members also have been greatly interested in trips to Rosyth Dockyard, Turnhouse Aerodrome and Leith Docks. Club roll: 63. *Secretary:* F. Anderson, 54, Falcon Avenue, Edinburgh.

St. Saviour's (Raynes Park) M.C.—The club recently celebrated its first birthday. Members are very keen to raise the standard of skill in Model-building. Special attention is paid to games, those available including billiards, darts, quoits and table tennis. A Lantern Lecture was given on "*Railways of Great Britain*." A cricket team has been formed. Club roll: 10. *Secretary:* R. Woollcott, 33, Crossway, Raynes Park, S.W.20.

Old Charlton.—Meetings are now held in the new club-room, which members have arranged in excellent order. An interesting talk on the most recent motor show was given by one member and other meetings were devoted to games and Model-building. Members are building much better models than formerly. Club roll: 29. *Secretary:* B. Stevens, 53, Mount Street, Charlton, S.E.7.

Maidstone M.C.—Recent visits to Tilbury Docks, where a P. & O. liner was inspected, and the East Malling Research Station have been specially interesting. At East Malling members were shown how apples are kept in storage for a considerable length of time without deterioration. Club roll: 14. *Secretary:* J. Elbourn, 91, Old Tovil Road, Maidstone.

Holy Trinity (Barnsbury) M.C.—The chief recent event was the club's Fourteenth Annual Exhibition. This was very successful, the receipts being £9 5s. 0d. A comprehensive display was greatly enjoyed by the visitors, who were specially interested in a model of the L.N.E.R. locomotive, "*No. 10000*," the giant Blocksetting Crane and other Super models. The prize-winning exhibits included a railway Breakdown Crane, an Aeroplane, a Windmill and a Jazz Band. A model railway was in operation throughout the Exhibition, and Lantern Lectures and Cinematograph Exhibitions were given at intervals. Members from several clubs in the London district attended the Exhibition. *Leader:* Mr. Stuart H. Wilson, 29, Thornhill Road, Barnsbury, London, N.1.

Stamford Hill M.C.—Pressure of business has led to the resignation of Mr. S. Goldberg, Leader, who has kindly undertaken the Presidency of the club. Mr. D. Weitzman is now acting as Leader. Members have been busy preparing models for their Exhibition, these including small models of the "Simplicity" type, and also Super models constructed by groups of members. Club roll: 32. *Secretary:* D. Weitzman, 83a, Stamford Hill, London, N.16.

Kendal M.C.—Cycle runs to the sea coast and to Oxenholme Engine Sheds have been enjoyed. One night was devoted to "Scouting," two members being given a short start before being tracked by the others. Wireless Evenings are held and a Debate on "*High Brow v. Jazz Music*" ended without a definite decision. Stocktaking has been completed and it was noticed that members worked cheerfully at this not very exciting task. Club roll: 21. *Secretary:* L. Haslam, Middleton, Kirkby Lonsdale, Carnforth.

Braintree High School M.C.—Recent meetings have included a Table Tennis Tournament and a splendid Lecture by the Dean of Bocking on "*Old Coins*," specimen coins being exhibited by means of the Episcope. Short Lectures on prominent docks were given by members. A Visit was paid to the Hoffman Works at Chelmsford. A general discussion on the club programme ended in a decision to introduce more Model-building Contests at club meetings. The result was the introduction of a "Packet Model-building Contest," entrants being given a number of parts, wrapped in paper, with which to build models. Club roll: 20. *Secretary:* M. K. Miles, Wordsworth Road, Bocking, Braintree.

St. James's, W. Streatham M.C.—The Exhibition was a great success. Many excellent models were submitted in the Contests arranged. In the Junior Section the First and Second Prizes were awarded to a Model Derrick and a Light Racing Monoplane, and in the Senior Section a Breakdown Lorry and a model of the Eiffel Tower gained the chief awards. An excellent display of Hornby Trains added to the attraction of the Exhibition. Club roll: 30. *Secretary:* C. Mizen, 64, Fallsbrook Road, Streatham.

A merry group of members of the cycling section of the Clacton and District M.C. This club was affiliated in February 1931 and has since made steady progress. Novel Model-building Contests are arranged regularly and this year special interest is being taken in outdoor recreations during the summer months.

CANADA

Westmount (Montreal) M.C.—Members exhibited Meccano models at the Hobby Show of the Montreal Y.M.C.A., winning two first prizes, two second prizes and an honourable mention. In addition a member of the club was awarded a first prize for a large model of a "Baltic" locomotive that was placed in a class by itself because of its many remarkable features. A special exhibit included the club's Hornby Railway and models of the Quebec Bridge and Block-setting Crane. Visits have been paid to the works of the Dominion Bridge Company, and the shops of the Canadian National Railways. Games have been introduced into the programme and during the summer rambles and visits and games of baseball are to be arranged. Club roll: 33. *Secretary:* F. S. Thomson, 695, Grosvenor Avenue, Westmount, Quebec, Canada.

NEW ZEALAND

Blenheim M.C.—A Stamp Section has been formed and interesting competitions arranged for its members. "Simplicity" and other Model-building Contests have been held in addition to Games Tournaments, all points awarded being entered in the sessional competition. Swimming races and cricket matches have been the chief outdoor pursuits, and a successful mock court has been held. Club roll: 18. *Secretary:* K. J. Orams, Redwood Street, Blenheim, New Zealand.

Christchurch M.C.—At the annual meeting, officers for the coming year were elected and the rules of the club considered in the light of experience. Visits have been arranged to Borthwick's Freezing Works and the Kaiapoi Woollen Mills. Ordinary model-building and other activities are being keenly pursued. Club roll: 30. *Secretary:* Mr. J. C. Fleming, 52, Cowlishaw Street, Avonside, Christchurch, New Zealand.

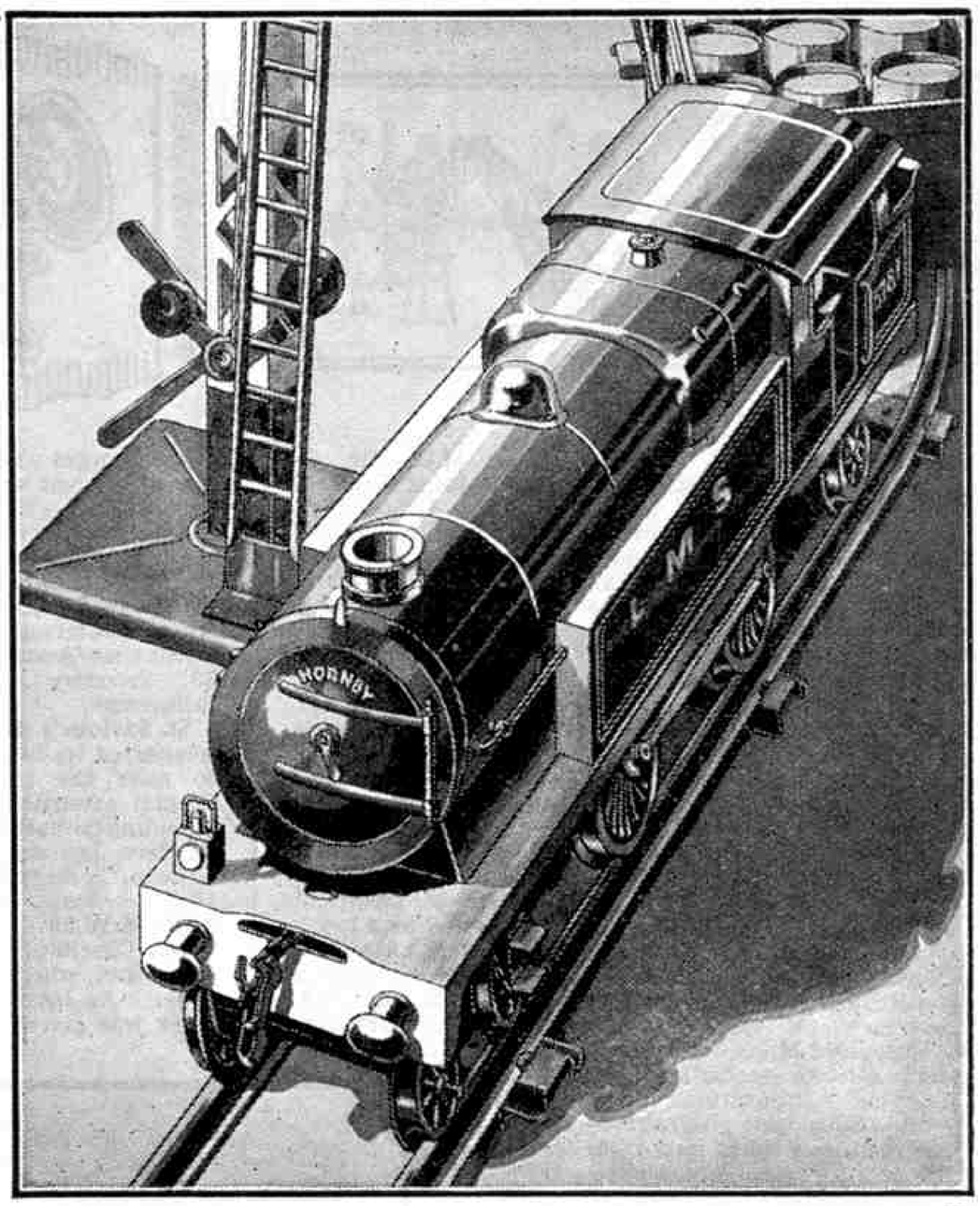
Clubs Not Yet Affiliated

West End Y.M.C.A. (Toronto) M.C.—At the first meeting of this newly formed club officers were elected and future arrangements made. Members bring demonstration models to meetings, and a small committee has been appointed to arrange for their construction by various members. Models so far shown include a Fire Engine, with a unique steering apparatus, and a Lorry with 4-wheel brakes. Swimming is the chief club recreation. *Secretary:* Earl Granner, West End Y.M.C.A., Toronto, Canada.

Rosemount (Montreal) M.C.—Meetings are held on Friday evenings in the club-room at 5781, Fifth Avenue, Rosemount, Montreal, kindly placed at the disposal of members by Mr. Grossmith. An excellent programme has been arranged and enquiries from intending members would be cordially received. *Secretary:* Jack Searle, 5850, 5th Avenue, Rosemount, Montreal, Canada.

New Hornby Locomotives for old!

Wonderful offer to owners of Hornby Trains



Just think of it, an allowance of 50% on your old Hornby Locomotive! This is the finest part exchange offer ever made.

You have probably been using a Hornby Locomotive for some years and would like to own one of the fine new models that now figure in the Hornby Catalogues. The object of the new Hornby Locomotive Part Exchange Scheme is to help you to do this.

The allowance that will be made for your old Locomotive is shown in the list of Part Exchange allowances for Hornby Locomotives given on this page. Please note that the catalogue price of the new Hornby Locomotive you purchase *must not be less than double the Part Exchange allowance made for your old Locomotive.*

No matter what the age or condition of your old Locomotive, you can exchange it under our "Part Exchange" plan. It is important to note that we cannot accept more than one old Locomotive in exchange for a new Locomotive.

What you have to do

Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose one of the new Locomotives, the cost of which is not less than 12/6 (or, in other words, not less than double the Part Exchange allowance we make for your No. 1 Tank Locomotive).

You decide, say, to have a No. 2 Special Tank, the price of which is 25/–. Pack up your old No. 1 Tank and deduct 6/3 from 25/– (the price of the new No. 2 Special Tank) enclose a remittance for 18/9 plus 1/– carriage on the new Locomotive—19/9 in all. Send the Locomotive and the remittance to Meccano Limited, Liverpool 13.

Alternatively, you can take your old No. 1 Tank Locomotive to your dealer with a remittance for 18/9, and he will give you the new No. 2 Special Tank Locomotive that you require.

Change your old Locomotive now!

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES	
MO Locomotive	1/4
M1/2 Locomotive	2/3
M3 Tank Locomotive	3/9
No. O Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
LEC 1 Locomotive (Swiss Type)	7/6
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
LST M3/20 Tank Locomotive (20-volt)	11/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
LST 1/20 Tank Locomotive (20-volt)	12/6
LE 1/20 Locomotive (Swiss Type), 20-volt	13/3
LE 2/20 Locomotive (20-volt)	16/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/–
OBSOLETE TYPES	
M2930 Locomotive	1/–
George V Locomotive (These models were identical)	3/3
No. OO Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan H.V. Locomotive	20/–

HORNBY TRAINS

MECCANO LTD. — SPECIAL SERVICE DEPT. — BINNS ROAD — LIVERPOOL 13

Branch Notes

HOLLANDERS (SPALDING).—The permanent track represents the L.N.E.R. main line, and loops in its course pass through stations representing Peterborough, York, and Newcastle. Variations are made in the layout in order to enable new timetables to be put in operation. The most recent alteration provided facilities for continuous working of four trains at once, and this led to the development of skill in points control. A series of Debates and Mock Trials has been held and now Cricket, Paperchases and Cycle Tours are being enjoyed by members. Chairman: P. J. Draper, Halmer Gardens, Halmer Gate, Spalding.

WOODFORD.—Extra meetings were held during "Branch Week." These included indoor and outdoor track meetings, a cross-country run, a Debate, and the Annual Sports. The Week was successful and an excellent means of increasing the enthusiasm of members. Secretary: J. H. Skelt, "Walberswick," Woodside Road, Woodford Wells, Essex.

CATERHAM SCHOOL.—On competition evening a demonstration of the block system was given and members were then asked to detect errors in the make-up and operation of trains. Lectures have been given on "*The Trans-Australian Railway*," "*The Railway Museum at York*," and "*The Romance of the Scillies*." A special feature is made of suggestions for improvement in Branch working submitted by members of the committee. Secretary: G. J. H. Dent, Caterham School, Surrey.

CHARMINSTER.—A large garage has been secured as a Branch room, and plans are now being discussed for a permanent track to be laid on a trestle table. Speed trials have been carried out, the contests between locomotives of different types arousing great excitement. A Lending Library has been established. Secretary: B. Guttridge, Tudor House, Malvern Road, Bournemouth.

HARLESDEN METHODIST.—An excellent layout was prepared for the Branch Exhibition and visitors were greatly interested in the skilful timetable working carried out by members. At the following meeting, Mr. G. B. Weightman, Chairman of the Branch, discussed the features of the Exhibition, and the talk will help to ensure an even more attractive display on future occasions of this type. Members took part in the Exhibition arranged by the Wembley Branch which also was very successful. Secretary: A. C. Durrant, 88, Burrows Road, Willesden.

STREATHAM PARK.—Intense interest is taken in track meetings. Operations represent the running of excursion trains from Euston to Glasgow, and of the "*Royal Scot*" and the "*Mid-day Scot*." At a particularly successful meeting a miniature "Rugby Special" was run from Euston to Edinburgh, its operation corresponding exactly with that of the "special" actually run on the L.M.S.R. for the International Rugby match between England and Scotland. Marks were given to members for their work on this occasion. The Hornby Control System has been introduced. Secretary: P. J. B. Doyle, 177, Ribblesdale Road, Streatham, London, S.W.16.

A group of members of the Whitgift School, Branch No. 67, photographed at the conclusion of a tour of the Meccano factory during their recent visit to Liverpool. Mr. F. Broadbent, Chairman, is at the back of the group and on his right is M. M. Young, Secretary. The Branch was incorporated in September 1929, and a splendid programme of Hornby Train operations and visits to places of interest is followed.

BLACKPOOL (NORTHERN SECTION).—By kind permission of Mr. R. B. Warburton, members now construct railway accessories in a well-equipped manual instruction room. A coaling stage, two gantries, a bridge and a cutting have been built and improved signalling arrangements are being made. One of the main lines is being electrified to represent a suburban track, and the construction of an "Underground" goods yard and an airport is being considered. Secretary: K. G. Davidson, 14, Sutherland Road, Blackpool.

1ST BIRKENHEAD.—Track meetings continue to be satisfactory. The layout is being extended and complicated timetables are being prepared. A visit was paid to the G.W.R. Engine Sheds, Birkenhead, where members were shown the controls of various locomotives. Secretary: W. W. Aslett, 9, Prenton Road East, Birkenhead.

AUSTRALIA

KEW.—A large layout for clockwork and electric trains has been operated regularly at meetings. Visits have been paid to the Newport Workshops of the Victorian Railways and to the Roundhouse at North Melbourne. Members also visited the exhibition of the Melbourne M.C., where they were greatly interested in the varied display of models and Hornby Trains. Secretary: A. J. McCutcheon, 20, Studley Avenue, Kew, E.4, Victoria.

PARRAMATTA.—Steady progress has been made with the Branch layout. The main line is practically complete and a siding has been laid down for use as a loop until the second terminal has been constructed. Future developments now under consideration will make this terminal a passing station. The line is worked strictly on the train staff system and at present is divided into two sections. Secretary: H. H. Matthews, 27, Ross Street, Parramatta, N.S.W., Australia.

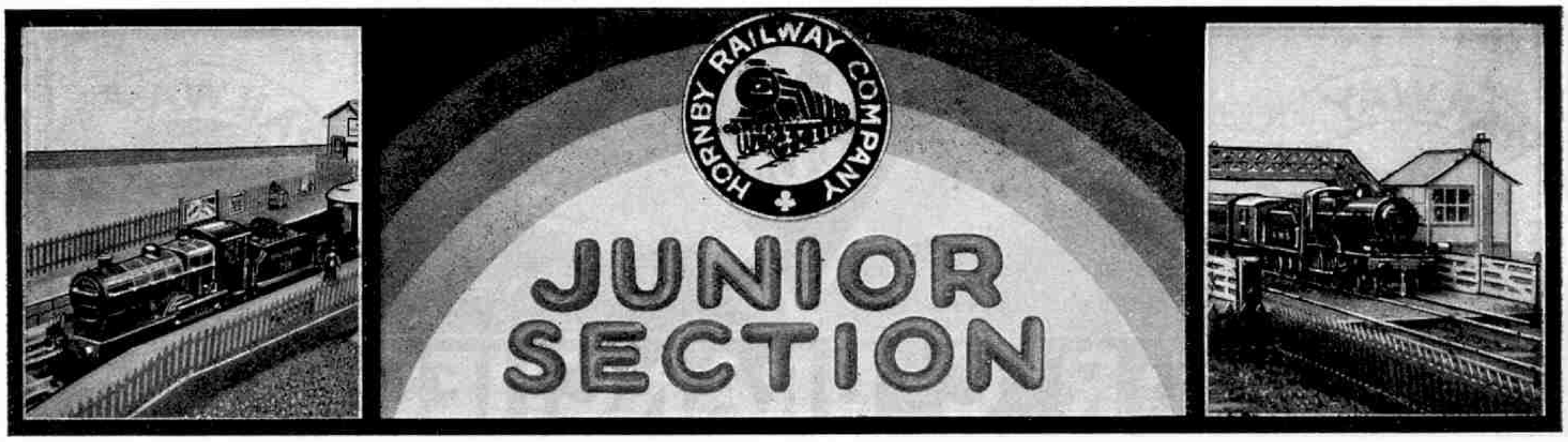
Proposed Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

AUSTRALIA—J. Stanbridge, 285, Lord Street, Perth, W. Australia.
CHELTENHAM—A. E. Crofts, Lloyds Bank House, Rodney Road.
KESWICK—N. H. Tysoe, 24, Blencathra Street.
LONDON—Wm. Harper, 62, Knotts Green Road, Leyton, E.10.
LONDON—M. O'Connell, Jr., 8, Eaton Square, S.W.1.
LONDON—A. H. Smith, 17, Fletching Road, Clapton, E.5.
NEWTON ST. CYRES—Rodney Branson, Coburg Cottage, Newton St. Cyres, Devon.
RICHMOND—A. Lovell, Skeeby, Richmond, Yorks.

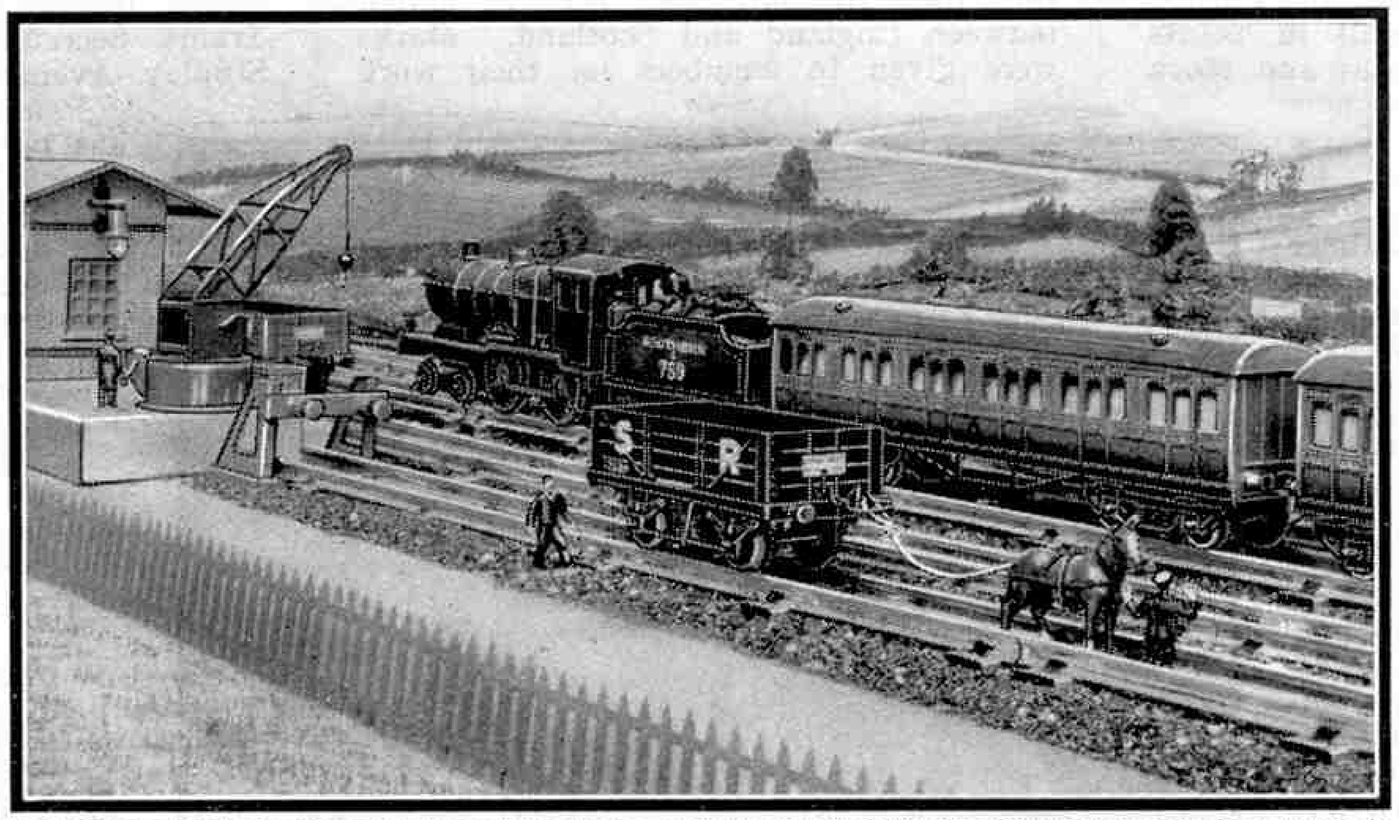
Branches Recently Incorporated

244. CHARMINSTER—A. Osborne, 86, Charminster Avenue.
245. SANDHURST—L. Green, The Garage, Sandhurst, Kent.



LV.—SHUNTING ON HORNBY RAILWAYS

THERE are few railway operations more familiar than shunting, and probably most of our readers have spent many an interesting hour in watching shunting work being carried out. The clink-bang of wagons and the hoarse cough of hard-working engines are well-known sounds, particularly at night in many districts. As a general rule the immediate outcome of watching any interesting railway operation is the desire to reproduce the same working as far as possible in miniature, and therefore most Hornby Railway owners make a practice of carrying out shunting operations to some extent. This month we will devote our attention to shunting methods and to various points to be noted with regard to their reproduction in miniature.

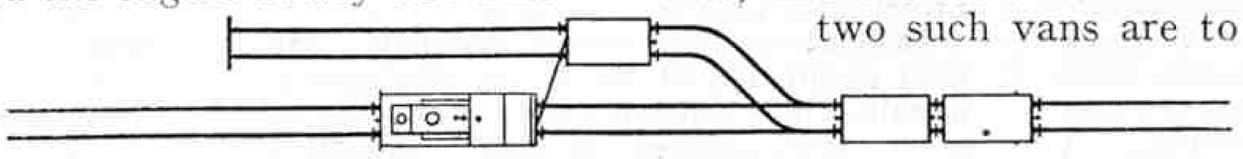


A simple method of shunting ! A miniature horse, suitably harnessed, is attached to the wagon by a " rope " made of string.

We are all familiar with the type of goods train known as the " pick-up," hauled by a locomotive displaying a single lamp over the left-hand buffer. It stops at intermediate stations on the journey, picking up wagons here, leaving others there, and so on. It is a type of train particularly suitable for reproduction on miniature railways, for the load behind the engine at any one time is not necessarily very large. The requirements of traffic govern the number and type of the vehicles used, so that the model railway operator has thus a fairly wide choice as to the manner in which he shall make up and run his train.

On a continuous layout of quite moderate dimensions a pick-up goods train may be run with success. Even though it stops at the same station or siding on successive circuits, different wagons may be dealt with on each occasion, so that the final formation of the train will be entirely changed from that with which it started operations. This will assist the illusion that numerous intermediate places are served on the trip. One of our photographs shows some interesting shunting work of this kind being carried out by a No. O Locomotive. It will be noticed that the Brake Van, which is of course a necessary part of each goods train, is left for the time being away from the wagons being shunted. This ensures that when the train is re-made and ready to proceed on its way, the van may be attached with the least possible trouble and delay.

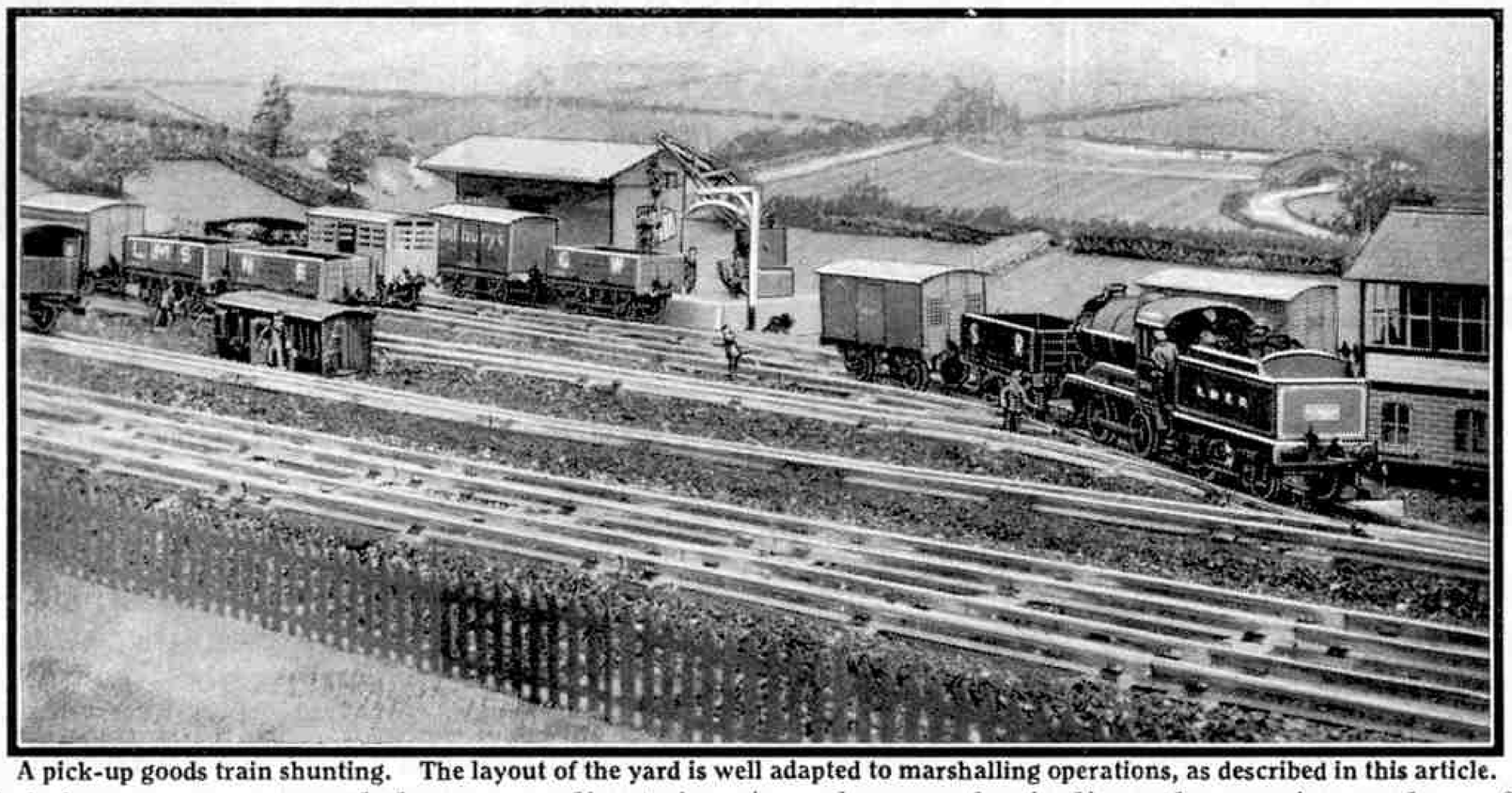
In order to assist the speedy uncoupling of different wagons, and to enable the various movements to and fro to be made rapidly, the sequence of the various shunts has to be clearly determined and kept in mind. Readers may find this awkward at first, but with practice they will find that their skill in handling the engine, the point levers, and the shunter's pole will increase considerably. It is a good scheme, when making up a train in definite order from a haphazard assembly of wagons, to allot consecutive numbers to the wagons. The job of the shunter is then to arrange the wagons in their proper numerical order in as few moves and in as little time as possible. The Brake Van would of course come last on the train in any case, and therefore need not be given a number unless two such vans are to be conveyed, and one is required to be in a certain place in the formation of the train.



An interesting method of shunting wagons into a dead-end siding. The locomotive tows them in by means of a steel cable.

Naturally it is not possible for the whole of the freight traffic carried by the railways to be dealt with by pick-up trains, or an enormous time would elapse between the despatch and the delivery of a particular consignment. What happens, therefore, is that at certain large centres traffic is concentrated and sorted out so that the wagons collected by various pick-up trains are re-distributed and assembled into other trains according to the nature and destination of their loads. This process of marshalling is therefore an important feature of railway work, and the names of such marshalling yards as Edge Hill, March, Banbury and Feltham will be familiar to most readers.

In order to allow traffic to be handled as quickly as possible at such points, considerable use is now made of gravity and hump shunting, yards where these processes are employed being known as "gravitation" and "hump" yards respectively. In the former the yard slopes gently from the reception sidings, where the trains arrive, to the sorting roads, so that when the engine has been detached the various wagons may be allowed to run down into the appropriate sidings. The hump type of yard has been highly developed, the L.N.E.R. example at March being well known. In this case a special hump or up-and-down gradient is arranged between the reception and sorting sidings. The wagons are propelled up the hump, which has a sharp descent immediately after its summit. They are uncoupled according to their destination, and on passing over the crest of the hump immediately begin to run down to the sorting sidings by their own momentum. The sharp descent enables individual trucks or "cuts" of several wagons to draw rapidly away from one another, so that there is a sufficient interval for the points to be operated as required.



A pick-up goods train shunting. The layout of the yard is well adapted to marshalling operations, as described in this article.

The installation of a hump shunting yard on a Hornby railway may be carried out quite successfully if there is sufficient space available. The incline may be arranged by mounting the rails on lengths of board supported at intervals by blocks of varying heights. The slope and extent of the gradient will depend upon the space available for the hump and its sidings; and of course the running qualities of the rolling stock, the usual loads, and the power of the engines to be used must also be allowed for. The requirements of hump shunting in actual practice have produced several designs of locomotive peculiarly adapted to the task of propelling big loads uphill at a steady rate of speed. The engine in the Hornby Series that best fulfils the requirements of heavy shunting service, both in appearance and in performance, is the No. 1 Special Tank. It is of compact design, with little overhang at front or rear, so that it can safely push vehicles over reverse curves without causing derailments. As its whole weight is carried on the driving wheels, and there are no bogies or pony trucks, the power of the engine is considerable.

It is often objected that clockwork locomotives run too fast to lend themselves to realistic employment as shunting engines; also that their speed when pushing a few wagons into a siding will result in derailments, especially if the wagons are empty. The speed will be kept at a moderate figure if the scheme of winding the engine only sufficiently for each move is followed. Where a couple of wagons have to be pushed for a few feet only, only a slight movement of the key spindle will be necessary. The requirements in this respect will be determined by experiment and practice.

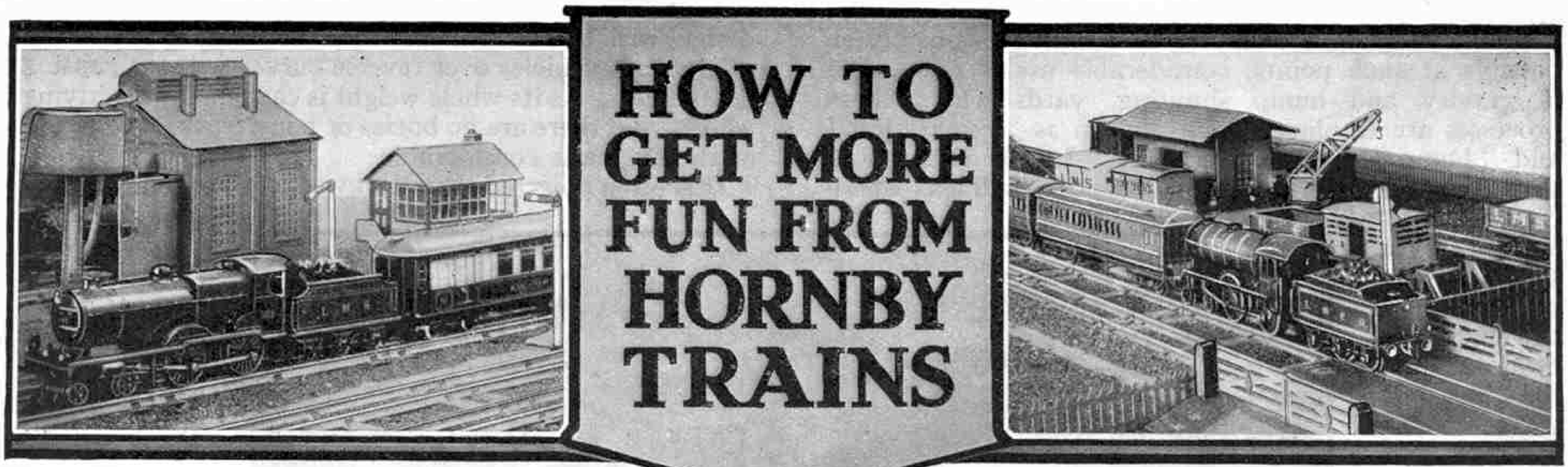
If the siding tracks are well laid, no trouble with derailments will then occur. The fitting of wagons with Mansell or spoked die-cast wheels improves their running considerably. The additional weight makes derailments a remote possibility, and gives the wagons as much chance as possible of reaching the farthest point to which they are required to run after they have been shunted off. Quite good results can be obtained with

Turntables are frequently used at large depots to transfer wagons from one line to another. In this photograph two Hornby No. 1 Turntables are shown employed in this manner.

the usual pressed steel wheels, however, when they are well lubricated. A further help in this direction is the avoidance of a complicated arrangement of points. A succession of ordinary right or left-hand points leading to the sidings will be the best arrangement, as the curves to be negotiated are then uniform, no matter which road is to be taken.

An unusual method of shunting is illustrated by the diagram on page 544. Here a locomotive is to leave a wagon in a siding, which is approached in the facing direction. The train stops, and the engine and wagon are uncoupled from the rest of the train. Then a steel cable is substituted for the coupling between the engine and the wagon, and the engine

(Continued on page 553



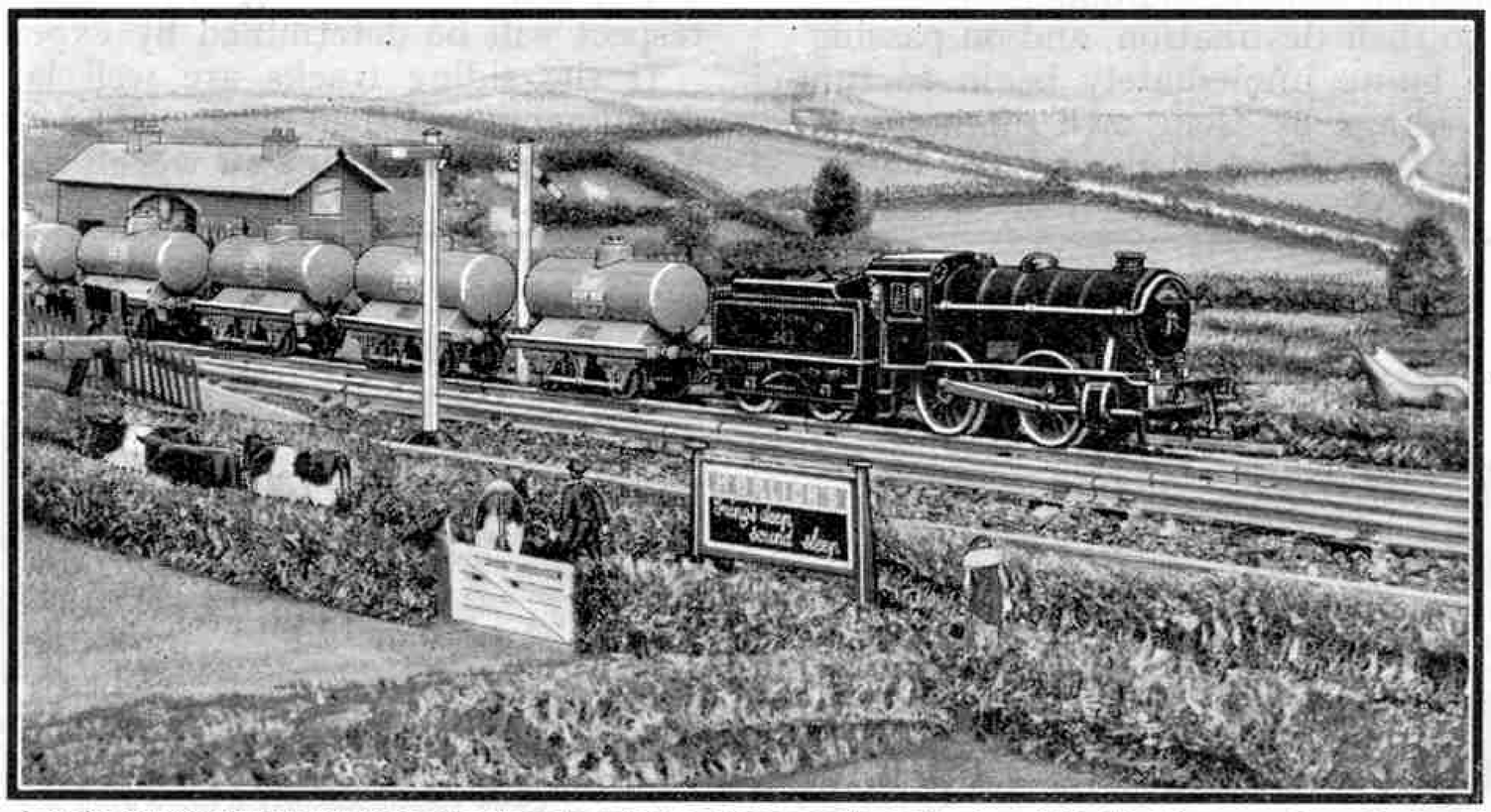
LVII.—A TYPICAL CONTINUOUS LAYOUT

IN the Junior Section pages of the May "*M.M.*" we considered a layout plan evolved by an H.R.C. member to represent the L.M.S.R. main line from Euston to Liverpool. Although many readers prefer this kind of system, they are often compelled by limitations of space to adopt rather less ambitious schemes. As a result, a very popular form of layout is the continuous oval track arranged with one or two stations, goods accommodation, and possibly a locomotive depot. We think, therefore, that the layout diagram shown on the next page will be found interesting, as it incorporates these features, and has certain special characteristics in addition. This layout has been developed and is operated by one of our readers, G. A. Fuller, of Pinner.

As will be seen from the plan, one passenger station is provided, but as there are two separate platforms the effect of two different stations may be obtained in working. Immediately adjacent to the station and inside the main oval is a large goods depot, reached by road by means of the overbridge shown. On the other side of the station are further tracks; then farthest away, owing to its dangerous nature, is a petrol depot, also served by a siding.

In what we may term the lower half of the layout there is an interesting series of lines making up the locomotive yard and some sidings. There is a two-road engine shed, and at the other end of the yard is a turntable ingeniously arranged to serve as a traverser between three separate roads. A certain length of the track leading to the shed is devoted to the coaling of locomotives, the fuel being transferred directly from wagons on an adjacent line.

It will be realised that the system is an interesting one, and quite a variety of train operations may be carried out on it. Although the main line is single track only, this is hardly a disadvantage where one operator alone is available. When clockwork locomotives are employed on a continuous track operated from the inside of the line, the trains are usually run in an anti-clockwise direction, owing to the locomotive key spindle being on the left-hand side. It is not very convenient to have to wind up the engine when the key spindle is on the far side, away from the operator. Of course if running in reverse is practised consistently with tank and tender engines alike, clockwise running may be carried out quite easily. However, we will take first of all one or two possible train movements in the opposite direction.



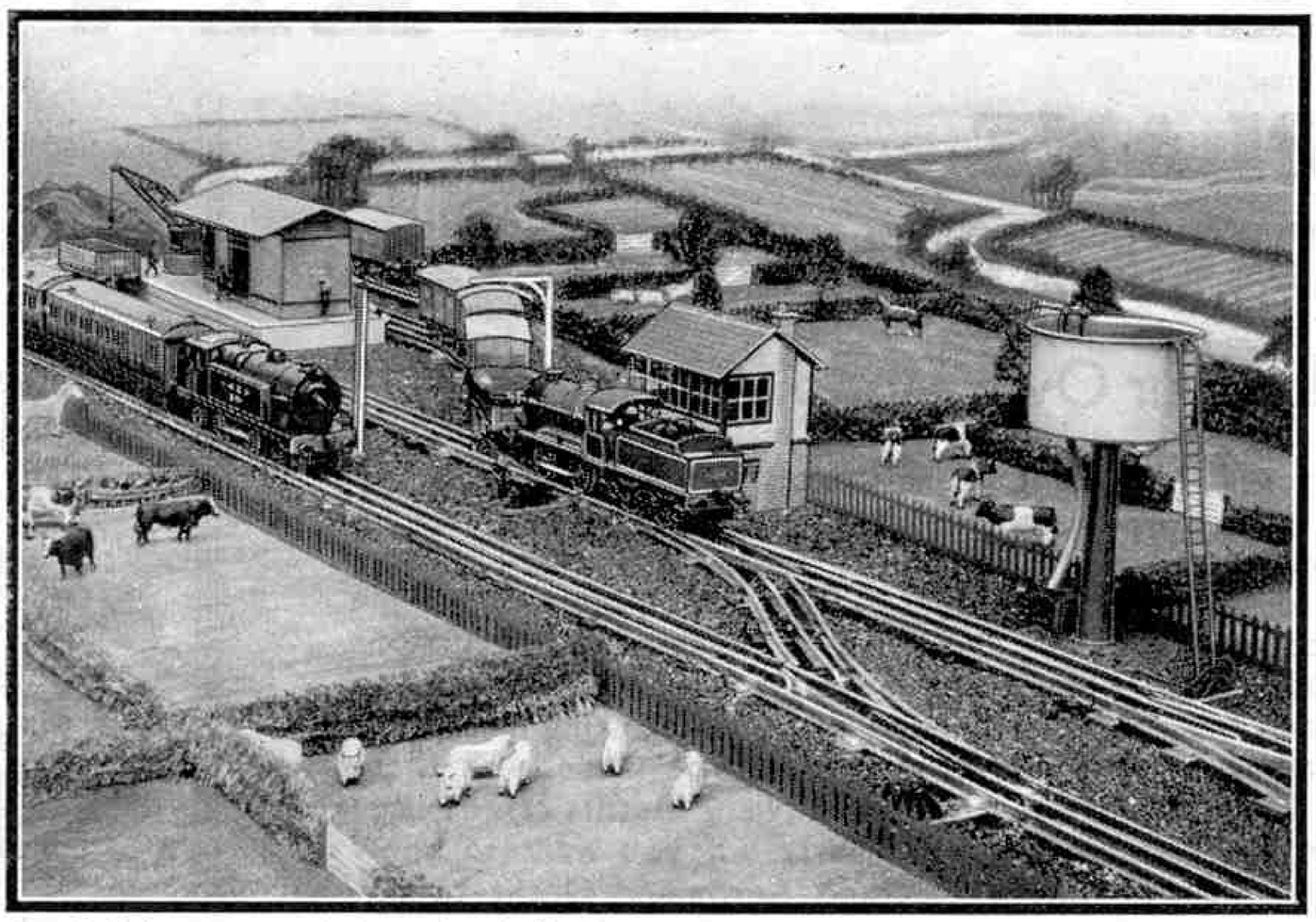
A train of Petrol Tank Wagons on a Hornby railway. The operation of trains of this kind forms an important part of the work on the layout described in this article.

Owing to the layout of the track at the passenger station, it will be seen that a train may be started on the far side of the station, and then be directed on to the main line and allowed to make as many circuits as desired. It may stop when required in the centre road at the station, according to the timetable or working arrangements. On its final arrival it may be switched into the road leading to the goods station, halting, however, alongside the passenger platform. If a return journey is to be made within a limited time another engine must be attached to the other end of the train, and the clockwise circuits may then begin.

If the arriving engine has to make the return journey also, and rather more time is available, the train may be backed out on to the main line and round into the siding alongside the engine shed which, by means of two sets of crossover points, is in effect a loop. The engine may then be detached and return to the main line. It then reverses past the engine shed, enters the siding, and so rejoins the coaches; or it may proceed right round the layout and run directly into the locomotive yard. Alternatively it may reverse by means of the second loop and the turntable, possibly being turned round on the

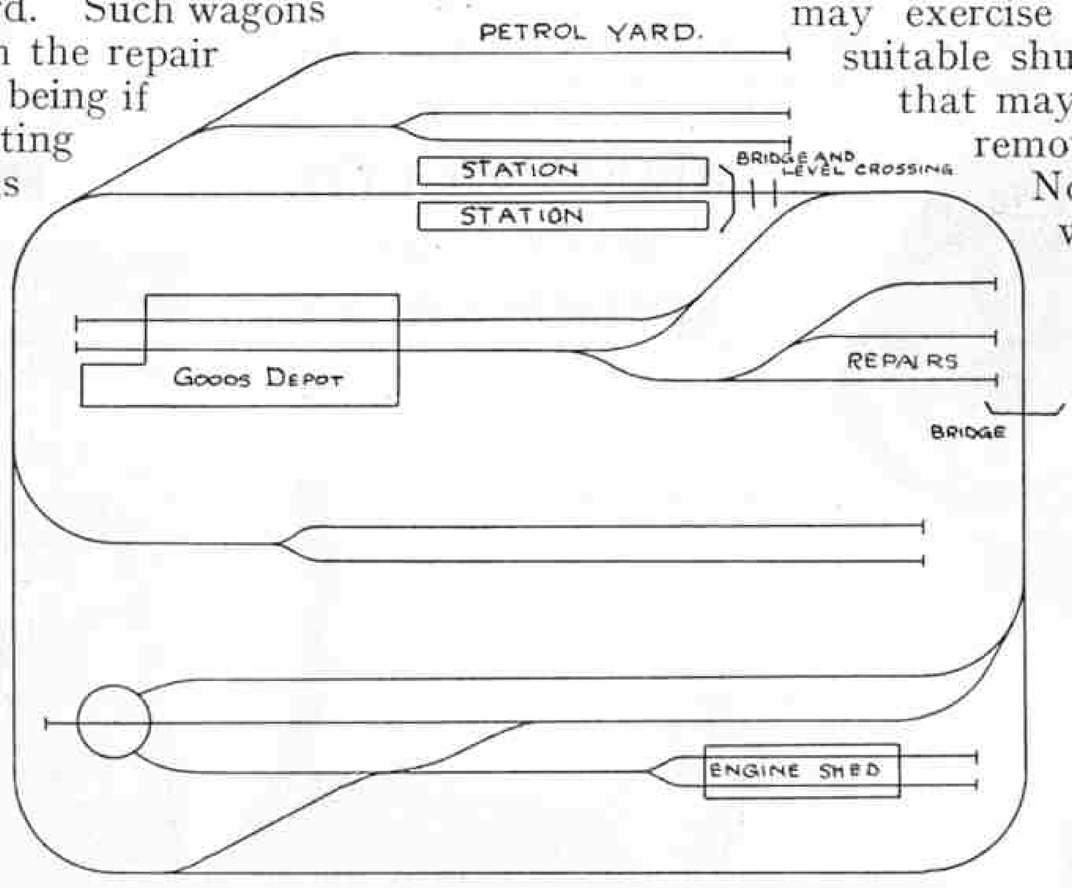
latter according to whether it is to make its return journey in reverse or chimney foremost. The journey of the empty train to the station may be made as preferred, either in a forward direction on to the main line by means of the two crossovers, or by a shunting movement in reverse, the coaches in the latter case being backed into the station.

Point to point running may therefore be carried out with return trips properly arranged; in addition continuous working of the usual kind is possible, in spite of the relatively simple nature of the main line and its connections. It is the actual disposition of the points and sidings, rather than any particularly complicated arrangement, that makes the layout so convenient for interesting operations.



A typical situation on a single track main line layout. A suburban train is passing a local goods station where shunting operations are going on.

Goods trains may be run in a similar manner. A train assembled in either of the two roads beyond the station may be despatched on a trip round the main line. Its first call perhaps will be at the station, to pick up further traffic waiting in the yard. Such wagons would have to be left ready in the repair portion of the yard for the time being if the train engine is to do the shunting operations. If a yard engine is available it will push the vehicles required out of the yard on to the main train, the engine of the latter having of course first uncoupled to allow this to be done. The next stop might be to attach empty coal wagons from the locomotive yard. Then on the next trip a run might be made through the yard itself, this now being clear of coal wagons. Such deviations are often made use of for goods trains, and quite a few special passenger trains, such as excursions. Thus for the sake of novelty our train may be made to take the loop road instead of the main line when required.



The layout referred to in this article.

Alternatively a train from the goods depot may negotiate the layout and directly enter either of the two sidings adjacent to the locomotive yard, perhaps without any intermediate stoppage. Express goods trains of this kind are quite a feature of modern railway operations, so that there is every reason for the inclusion of similar trains in the working arrangements of a miniature system.

This point to point running may be applied to trains of petrol tank wagons run in connection with the petrol depot situated at the top of the layout. If the depot is supposed to be maintained by any one firm interested in the marketing of petrol, then the tank wagons should really all be of the same kind. It will be more interesting, however, to assume that different brands of spirit are handled there, for this will result in a variety of wagons being employed. A very good selection of Petrol Tank Wagons is available in the Hornby Series, and an attractive train may be made up by employing one or two examples of each kind.

Certain restrictions on the movement of these trains may be laid down, thus imitating the regulations that apply in real practice in connection with such dangerous traffic. Thus the running of petrol trains may be confined to certain definite periods when other traffic is slack. Particular care should be observed in shunting, and locomotives of normal type should not be allowed inside the depot. Readers who adopt such a feature as a petrol depot on their layouts may exercise their ingenuity to evolve a suitable shunting unit. A simple scheme that may appeal to some would be the removal of the chimney of an old No. 1 Tank Locomotive, which would thus give a reasonably accurate representation of a fireless locomotive. These special engines are commonly used on premises where it would be dangerous to employ the normal type of locomotive owing to the possibility of fires or explosions being caused by sparks.

On a layout of this kind, where traffic is really of a more or less local character, tank engines may be employed for practically all sorts of work. One of our photographs shows a No. 2 Electric Tank Locomotive hauling a passenger train. This engine, or the corresponding clockwork one, would be very suitable for the more important passenger duties on a line of this kind. Although they are the largest tanks in the Hornby Series, they can be accommodated on the No. 2 Turntable—a useful feature where the turntable also functions as a traverser, as on the layout described.

This advantage is also shared by the smaller tender engines of the Series, examples of which also appear in our illustrations. Thus readers who prefer this type of engine may turn them without difficulty.

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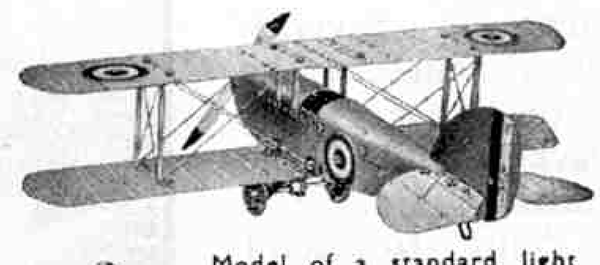
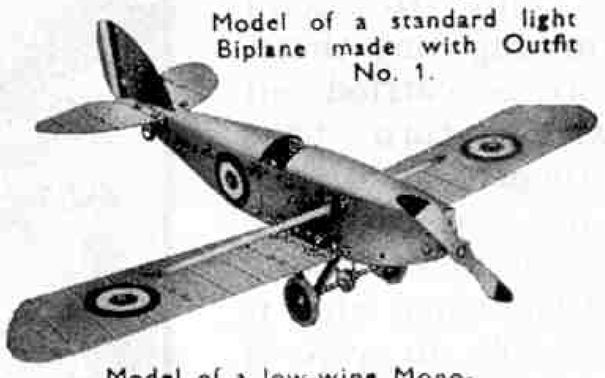
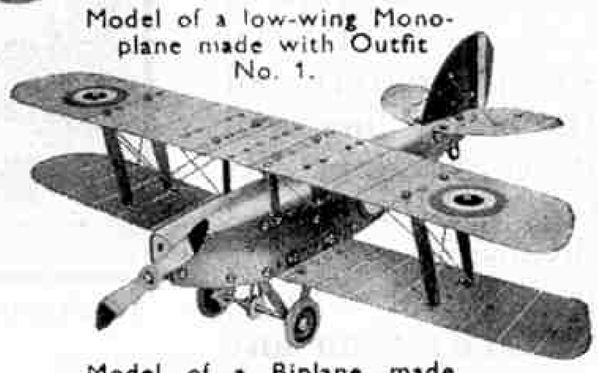
Note. The parts in the No. O Outfit are smaller than those in Outfits Nos. 1 and 2, and are not intended for use with the larger Outfits.



Model of a standard light Biplane made with Outfit No. 1.



Model of a low-wing Monoplane made with Outfit No. 1.



Model of a Biplane made with Outfit No. 1.

Model of an Italian bomber made with Outfit No. 2.

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H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

FAMOUS TRAINS CONTEST

The practice of giving names to railway locomotives and to the more important expresses has been developed systematically during recent years and has met with general approval on the part of the travelling public. A named locomotive or train possesses an individuality that can never be acquired by one distinguished only by a number or a starting time. A journey from Paddington to Plymouth, for instance, seems a far more interesting event when made by the "*Cornish Riviera Express*," hauled by "*King George V*," than the same journey made merely by the 10.30 from Paddington hauled by engine No. 6000. We take a personal interest in a named train just as we do in a ship, and it is impossible to imagine a ship without a name.

In the panel in the centre of this page appear the names of 16 famous express trains. For our contest this month we invite readers to write down in respect to each item; the names of the terminal points between which the train runs; the distance travelled; the operating company; the longest tunnel passed through and the situation of any water troughs along the route. In order to make this contest more interesting we have omitted the four most famous expresses, "*The Royal Scot*"; "*The Flying Scotsman*"; the "*Cornish Riviera Express*" and the "*Golden Arrow*"; and have included a number of less famous trains. Some of these trains make cross-country journeys which are not so easy to follow as those of the four expresses just mentioned.

THE
THAMES-CLYDE EXPRESS
ULSTER EXPRESS
THE QUEEN OF SCOTS
CAMBRIAN COAST EXPRESS
TORBAY LIMITED
THE YORKSHIREMAN
THE DEVONIAN
ABERDONIAN
THE SCARBOROUGH FLIER
THE LANCASTRIAN
THE HOOK CONTINENTAL
THE MANCUNIAN
THE MERSEYSIDE EXPRESS
BOURNEMOUTH LIMITED
SOUTHERN BELLE
ISLE OF MAN BOAT EXPRESS

The contest will be divided as usual into two sections—Home and Overseas. To the senders of the four best entries in each section prizes of Hornby Train goods (or Meccano products if preferred) will be awarded to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition there will be a number of consolation prizes.

Envelopes containing entries should be clearly marked "*H.R.C. Famous Trains Contest*" in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st July, 1933. The closing date of the Overseas Section is 31st October, 1933. All entries must bear the competitor's name and full address together with his H.R.C. membership number, and they will be disqualified if they reach Headquarters after the published closing date.

Railway Photographic Contest

The wide range of subjects submitted in the May contest show that many very interesting photographs would have been lost to us if the contest had been confined to one particular railway item. For this reason we have decided to adopt the same policy for our July contest. We therefore announce a "*Railway Photo Contest*" in which members may enter any photograph that has a railway connection. The only restriction is that each exposure must have been made by the competitor, but the developing and printing may be the work of a professional.

Competitors may submit as many prints as they desire, but no competitor can win more than one prize. It is important that every print sent in should have on the back a description in a few words of the railway features shown, and the name, address and H.R.C. membership number of the sender. Omission of this number will result in disqualification.

The contest will be divided, as usual, into two sections, Home and Overseas; and prizes of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the best photographs submitted in each section.

Envelopes containing prints should be clearly marked "*H.R.C. Railway Photo Contest*," and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 31st July. Overseas closing date, 31st October.

Drawing Contest

In previous Drawing contests we have usually indicated a definite subject. This month we leave competitors to select their own subject. In order to enter this contest, therefore, all that is necessary is to submit a drawing of any item of railway interest. This freedom from restrictions gives every H.R.C. member an opportunity of drawing his favourite subject or the one with which he happens to be most familiar.

The competition will be divided into the usual two Sections—Home and Overseas. To the competitors who submit the four best entries in each of the two sections will be awarded prizes of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be awarded to those competitors whose entries do not quite come up to prizewinning standard.

Envelopes containing entries should be clearly marked "*H.R.C. Railway Drawing Contest*" in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st July. The closing date for the Overseas Section is 31st October. Members' H.R.C. numbers must be quoted. The closing dates should be carefully noted as entries received late cannot be passed on to the judges.

Unsuccessful entries will be returned if they are accompanied by a stamped addressed envelope of suitable size.

COMPETITION RESULTS

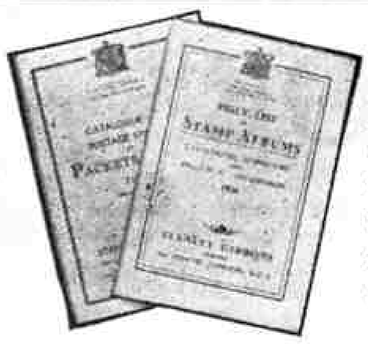
HOME

April "Hidden Stations Contest."—1. D. Morgan (9824), Bruton. 2. H. C. Thompson (25825), Liverpool. 3. L. C. Barber (21144), W. Worthing. 4. V. Knill (26118), Thorpe Bay. Consolation Prizes: H. Andrews (18415), London, S.E.18; R. Brown (19550), London, N.W.10; A. E. Poyser (11567), Gloucester; D. W. Millington (22403), Bedford; S. Bell (34407), Bootle, Cumb.; J. T. Aldren (3226), Birmingham 5; C. E. C. Hebert (34428), Thames Ditton; F. G. Beadle (3125), Buxton; F. Heslop (5987), Doncaster; J. Williams (9546), Braystones; G. H. Preston (12020), London, W.13; C. Latham (1049), Bristol.

April "Railway Photo Contest."—1. S. Garbutt (30122), Altrincham. 2. R. A. Shone (26361), Ashton-in-Makerfield. 3. E. G. Cutbush (10353), Belvedere. 4. R. C. T. Lyle (30157), Hereford. Consolation Prizes: W. R. J. Matheson (24597), Inverness; V. J. Taylor (9814), Louth; J. Pearce (32770), Northampton; J. Everitt (542), London, S.W.16; W. B. Hudson (1733), Weymouth; J. G. Spence (27737), Caterham; J. Turley (18853), Tun. Wells; R. Webb (383), Hove; R. E. Weaver (30863), Bearsted; W. T. Wilkinson (12897), Haydock.

April "Signal Cabin Drawing Contest."—1. C. A. Brunt (10229), Leeds. 2. R. Smith (14750), Ossett. 3. T. W. Gregory (34228), Tipton. 4. R. L. Martin (4283), Cheltenham. Consolation Prizes: H. Sutcliffe (4855), Horbury, Br.; D. Cheverton (31791), S. Harrow; J. A. Ecclestone (20575), Shrewsbury; H. Smith (3701), Clewer Windsor; A. W. Addie (17707), London, S.W.2; A. Lucking (3556), Witham; C. E. T. Harris (27133), London, N.W.7; C. A. Manship (29150), Portsmouth; A. Sweeney (26846), Belfast; B. Floyd (34408), Knutsford; H. Maasch (23994), Hove; R. Watson (24608), Birmingham 9.

OVERSEAS

January "Railway Jokes Contest."—1. W. H. Jack (8958), Ballarat E. Aust. 2. R. L. Chegwyn (33862), Florida, S.A. 3. A. McIntyre (30925), Winnipeg. 4. H. C. Key (24764), Calcutta. Consolation Prizes: H. J. Borgman (29579), Holland; G. C. Gera (29165), Malta; M. L. Morgan (22858), Cremorne, Aust.; V. Mahon, Hawkes Bay, N.Z.; E. C. Heath (29104), W. Pennant Hills, Aust.; A. McMillan (28869), Nanaimo, B.C.; A. V. A. Hing (13801), Bendigo, Aust.; P. D. Charlwood (30116), Sydney.

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For further Stamp Advertisements, see page 552

Stamp Gossip

and Notes on New Issues

An Attractive Moroccan Issue

An outstanding feature of the stamp world in recent years has been the improvement in the standard of production of French Colonial issues. Previously their only attraction lay in their crude blaze of colour; to-day there is an interest in the designs that ensures a welcome from the stamp collector.

The recent Moroccan issue is no exception, the designs providing views of many of the famous places of this Mediterranean show country. We have selected the 10Fr. value for illustration, for it shows a portion of what is considered to be the finest remaining piece of Mohammedan architecture, the Tombs of the 16th and 17th century Saadian Sheriffs at Marrahech. The same design is used on the 5Fr. and 20Fr. values.

The full series contains 22 stamps, of which six are for air post use. The remaining designs are Moulay-Idriss (25c., 30c. and 40c.); G.P.O., Casablanca (10c., 15c. and 20c.); Tangiers (1c. and 2c.); Agadir Bay (3c. and 5c.); the Old Capital, Rabat (45c., 50c. and 65c.); interior of the College of the Attarine Mosque at Fez (75c., 90c., and 1Fr.); and Ouarzazat (1Fr. 50, 2Fr., and 3Fr.). The air stamp designs are an aerial view of Rabat (50c., 80c. and 1Fr. 50) and a similar view of Casablanca (2Fr.50, 5Fr. and 10Fr.).

* * * *

The latest American commemorative marks the 200th anniversary of the founding of the State of Georgia, and a portrait of the founder, General Oglethorpe, an Englishman, is used for the design. General Oglethorpe entered Parliament in 1722, on his retirement from the army, and 11 years later persuaded the Government to found a colony in Georgia for released debtors. He went out to America as first Governor and held office for 13 years, then returning to England where he lived to the advanced age of 89.

* * * *

We reproduce here the design that is used for Egypt's new air mail series. It shows an Imperial Airways machine flying over the Pyramids. The same design is used for each value in this set of 20 stamps.

Papered with Stamps

Freak materials for the papering of rooms are not uncommon. Match box labels and orange wrappings have been used, and we recall the early postwar days when the value of the German mark was plunging so fiercely downward that not a few folk hit upon the idea of papering rooms with German bank notes! Stamp collectors have often heard the fable of the collector who papered his study with copies of "British Guiana 1 cents" and "Cape Triangulars" in the days before they were scarce.

There does exist a room papered entirely with postage stamps, however, and this is at the old home in Chipping Sodbury of Dr. Ludford Freeman, the Director of Education at Bristol. Some years ago Dr. Freeman's father was given a few thousand old postage stamps, and he conceived the idea of using them to paper a bedroom. Ultimately some millions of English and foreign stamps were used in the process, which occupied nearly three years. The stamps were not pasted down haphazardly, but due regard was had to design.

An Orange Commemorative

In our last issue we made a brief reference to the Dutch stamp series commemorating the 400th anniversary of the birth of Prince William of Orange. The series contains four stamps, 1½c., 5c., 6c., and 12½c.; and the designs for the three higher values are taken from old Dutch portraits. The lowest value shows the arms of the House of Orange and the motto *Ie Maintiendray*, "I will maintain." William, known as "the Silent," was born in 1533, and reigned from 1544 until he was assassinated in 1584.

A Striking Animal Design

This month has been remarkable for several extremely interesting and well-produced new issues. Eritrea and Tripolitania, Italy's North African colonies, have been responsible for two extremely striking issues, one celebrating the 50th anniversary of Italian rule, and the other the 7th Tripoli Exhibition. There is not space to describe the issues in detail, but we have selected the 5L. stamp of the Tripolitanian issue—an arresting picture of a crouching leopard—to illustrate as typical of the productions generally. The 1L. 25c. and 10c. stamps of the same issue feature an African eagle and an ostrich respectively.

English Design for Soviet Stamp!

It is not within the province of the "*M.M.*" to comment upon the international political situation. We cannot help remarking, however, upon the curious coincidence that the only Soviet stamp to bear an English design should appear at a moment when there is estrangement between Britain and Soviet Russia. The stamp is the 10K. value of Russia's issue commemorating the 50th anniversary of the death of Karl Marx, the father of Communism, and the design reproduced here shows his grave in the Highgate Cemetery in London.

Stamp Printing in South Africa

The Union Government printing office has issued some interesting figures in regard to its stamp-producing work during the financial year 1931-2. These figures show that slightly more than 165 million postage stamps were printed, the 2d. stamp accounting for 118 millions and the 1d. value for 37 millions. The 3d. stamp totalled 6,500,000 and the 6d. stamp 5,000,000. The 3d. stamp was the most expensive to produce, the printing cost being as high as 1/3 per 1,000. The 1d. stamp was the cheapest, the figure for this being 4.5d. per 1,000.

Death of Mr. Arthur Hind

The death of Mr. Arthur Hind, the most famous of modern American collectors, foreshadows a stamp sale that will rival in interest that of the Ferrari collection in 1921. His collection contains practically everything listed in standard catalogues.

The gem of the collection is the unique 1c. British Guiana of 1856. Formerly this stamp was in the Ferrari collection, and at the Paris sales there was a sensational duel for possession between Mr. Hind and the Strasbourg collector M. Maurice Burrus. The ultimate price was equivalent to £7,343 in English currency! Other items of special note are two magnificent unused specimens of the "Post Office" Mauritius 1d. and 2d., and an envelope bearing the 1d. and 2d. used together. Mr. Hind paid £11,000 for that envelope!

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

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,, 29	LAURENTIC	Immingham	Baltic Ports	13	£18
,, 29	DORIC	Liverpool	Norway, Fjords, &c.	14	£14
,, 30	DORIC	Greenock			
Aug. 3	CALGARIC	Liverpool	Spain	8	£8
,, 5	ADRIATIC	Liverpool	Madeira, Spain, &c.	12	£15
,, 12	HOMERIC	Southampton	Atlantic Isles, &c.	14	£20
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100 DIFFERENT STAMPS FREE.—Send for ½d. approvals.—Cox, 21, Dennis Mansions, Westcliff.

Three Caymans Centenary Free to genuine approval applicants.—Sanders, Newlands Ave., Southampton.

The Story of Prince Lee Boo—(*Cont. from p. 515*)

and a tombstone was erected to his memory by the company " as a Testimony of Esteem for the human and kind treatment afforded by His Father to the Crew of their Ship, the '*Antelope*'."

The company sent gifts of cattle and useful articles to King Abba Thulle by an early ship, and Mr. Sharp, who was aboard, was able to tell the King the circumstances of his son's death and to convey the Prince's last message. The old King was overwhelmed by the company's presents, but he was greatly disappointed that Captain Wilson had not accompanied Mr. Sharp. The surgeon tactfully explained that the Captain had been promoted to a larger and more important ship that was too big to visit Pelew, and the King accepted this explanation.

Meccano in Engineering—(*Cont. from page 493*)

smaller lamps were off. After some experiment Mr. Bannister designed a mechanism for tripping the gas valves at the correct intervals. The mechanism proper was constructed in the orthodox manner from pieces of steel and rods, but in the drive arrangement was incorporated a reduction gearing made up of standard Meccano gears. The apparatus was in use for a fortnight, and during that time the controller worked continuously for five hours per night without giving the least trouble.

In view of the very heavy duty the Meccano parts were called upon to fulfil in each of the three mechanisms described here, their splendid performance is a fine tribute to the accuracy with which the teeth of all Meccano gears are cut, and to the high quality of the materials from which they are made. Such performances as these fully justify the claim that Meccano is real engineering in miniature.

Mr. Bannister informs us that when he was a boy he was the proud possessor of a No. 5 Meccano Outfit, and his only regret, now that his boyhood days are over, is that he cannot find the time to indulge in " the finest hobby in the world."

MECCANO WRITING PADS are supplied in two sizes, each consisting of 50 printed sheets of tinted paper with cover. Price—Large, 1/– each, and small, 6d. each (post free).

ENVELOPES to match. Price, per packet of 50, 8d. post free.

Meccano Ltd., Binns Road, Liverpool 13.

African Railway—(*Continued from page 523*)

Provided that the subsidence was regular, however, it could be negotiated; though it was strange to see the wheels of the trucks ploughing their way forward through the earth and throwing up gouts of mud and grass-tufts as they slowly revolved.

Railway accidents as usually understood were unknown, for the slow speed of the trains prevented anything in the way of a serious smash. But minor derailments caused by the sinking of the metals into a newly-dug ant-bear hole, or by the buckling of a rail, were almost regular events.

It was fortunate that the locomotive and trucks were not excessive in weight, for the method employed in returning them to the metals they had left was primitive. Screw-jacks with wide bases were always carried, but unless the ground were hard and dry the use of them resulted in the screwing of the jack into the ground, not the raising of the engine. Luckily, however, there were innumerable trees always handy. The native passengers were dispatched with axes to cut timber and place it under the screws, while long stout poles were also brought to act as levers. With the combined efforts of the passengers, white and black, and the trio that formed the crew of the train, the defaulting engine or truck was eventually persuaded to resume its correct position. A sweaty job under the tropical sun, but one that was looked upon by all as part of the day's work—and fun!

To-day standard gauge trains run over the approximate route taken by the old track, and a smart uniformed guard examines tickets where his shirt-sleeved pipe-smoking prototype once ruled. The time taken in performing the journey has been halved, and during that period the train reaches a destination far beyond the old terminus. But those who remember the narrow-gauge railway will never forget it, for the old line had a strange charm—that of quaintness and of unexpected happenings.

Electric Winding Engines—(*Cont. from p. 501*)

they would be travelling at such an alarming rate that the safety of the miners would be endangered if it became necessary to apply the brakes suddenly. In addition to the electric controller, therefore, it is usual to equip the winder with an automatic speed accelerating device, which enables the speed of the winder to be kept under control independently of any skill on the part of the driver. This device not only maintains a safe maximum high speed of acceleration, but also ensures the completion of each wind in the maximum length of time.

Another very important part of the winder plant is the braking apparatus. This has to be very efficient, for it must be remembered that it has to deal with cages travelling at a very high speed. In old type winding machines the brakes were very crude and uncertain mechanisms, and were nothing more than shock absorbers of more or less elaborate design. Metropolitan-Vickers Co. Ltd. have now introduced what is known as the "Metro-Vick Governed Brake," a device by which the winder is brought to rest quite smoothly and at a predetermined rate of de-celeration, even when the brake is used in an emergency.

In many of the early devices the brakes were operated by the fall of dead weights, the rate of fall of the weights being limited by some type of shock absorbing mechanism. In the Metro-Vick Governed Brake, however, the actual change of speed of the cage or cages themselves is used to control the application of the brake.

The system makes use of a brake engine, the piston-rod of which is connected by a link and lever system to brake straps working on the winder drum. The movement of the piston-rod, and therefore the operation of the brake straps, is controlled by an inertia governor and valve. The driver's brake lever works in a calibrated frame, on which are indicated various rates of retardation in feet per second. Movement of the lever operates the sleeve of a main control valve, by means of which a supply of oil is admitted to the mechanism of the inertia governor, which in turn admits pressure to the piston of the brake engine. The piston is then forced downward, thus operating the link gear and applying the brake straps. As the shaft of the inertia governor is driven by gears from the drum shaft of the winding engine, the pressure with which the brakes are applied is determined by the speed of the drum. The result is very smooth and entirely shock-free retardation. In case of emergency the brake gear is operated through the inertia governor by means of a solenoid.

Wagon Tipping Plants—(*Cont. from page 506*)

the platform is left clear to allow a locomotive to withdraw the empty truck. Plants of this kind can handle eight to twelve wagons per hour. A 20 h.p. winding motor is sufficient to handle loaded trucks up to 20 tons gross weight, while 30-ton trucks can be dealt with by a 30 h.p. motor.

When end-opening wagons only have to be handled, it is more convenient to discharge them by tipping them endways. This is done simply by elevating one end of the wagon and letting the contents flow out, and the usual method is by means of a ram tipper, operated either by an electric motor or by hydraulic power.

The truck to be tipped is run on to rails placed over a discharge pit, and between which is a steel cradle that forms the tipper proper. One end of the cradle is provided with wheels that run between steel guides; the other end is pivotally connected to the end of a stout steel ram on one side of which are rack teeth. The upper end of the ram terminates in a U-shaped piece of steel, and the ram itself is worked up and down by an electric motor that drives a pinion in mesh with the teeth on the ram. The motor and its accompanying gearing is sunk below the level of the ground, and a deep pit is excavated to allow the ram free vertical movement. The method of operation is as follows. The truck to be emptied is run into position over the lifting cradle and the electric motor working the ram is set in motion. The ram and cradle slowly rise until the U-shaped end of the ram engages an axle of the wagon. Continued movement of the ram causes the cradle and wagon to be elevated at one end, the other end of the cradle meanwhile being drawn on its wheels towards the ram. Eventually the wagon is inclined at such an acute angle that its contents are discharged into the pit.

The cradle elevates the buffers on the lower end of the wagon above rail level, so as to prevent them from fouling the running rails, and permitting a high angle of tip to be obtained.

Bridges of Transporter Type—(*Cont. from p. 507*)

but at high-water level gives a clear height of 137 ft. 9½ in. It crosses the river in a single span 254 ft. 3½ in. in length, from the centres of the towers, and provides for shipping a clear width of waterway of 175 ft. 6½ in.

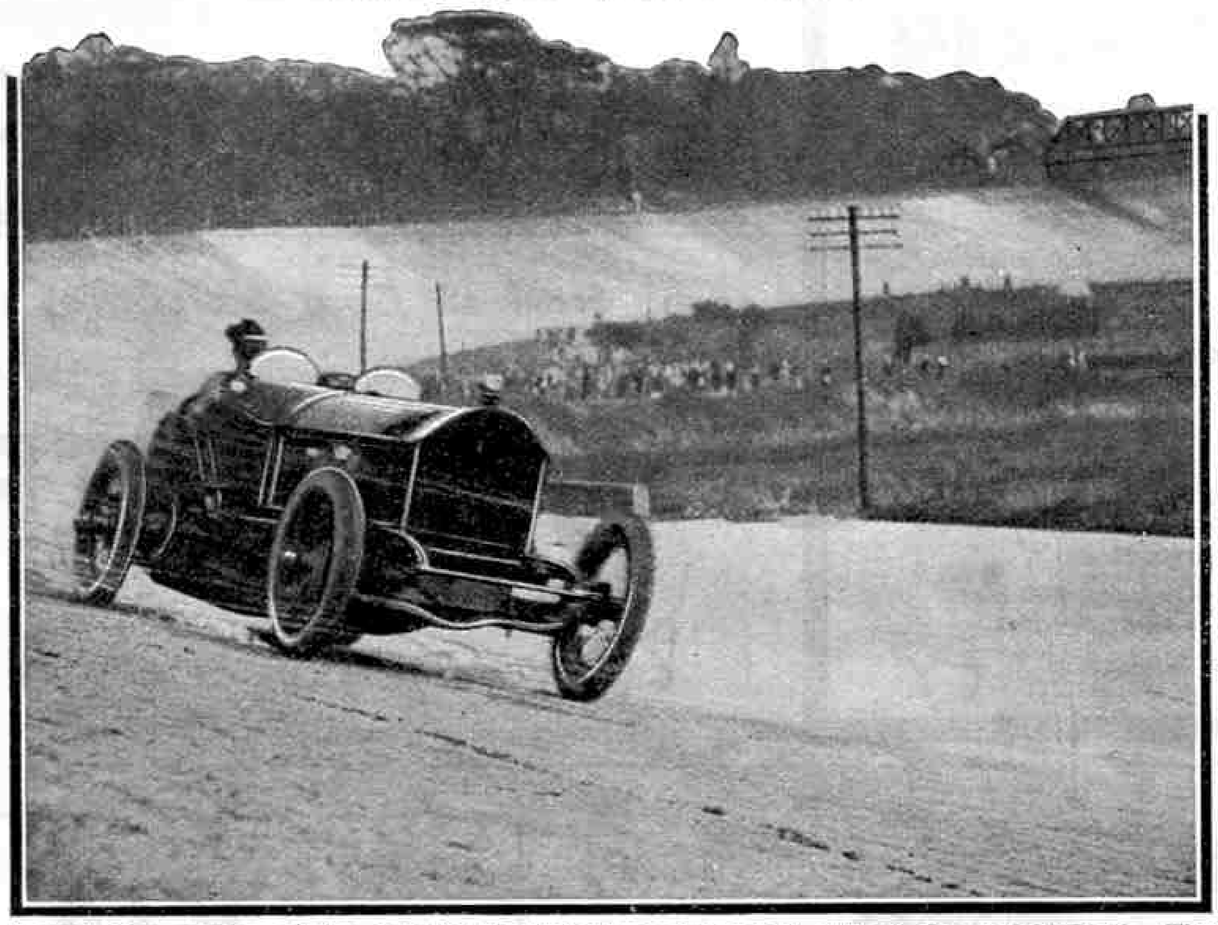
The bridge superstructure consists of two masonry girders spaced 55 ft. 9½ in. apart, centre to centre, that rest upon knuckle bearings centred on the tops of the towers, one at each end of the bridge. Each tower has eight raked trestle legs, which are braced together in pairs by horizontal lattice struts and diagonal ties. Each leg is anchored to its masonry pier by four huge holding-down bolts 16 ft. long by 2½ in. in diameter, which pass through a baseplate 8 ft. square by 1 in. thick. The tops of the two halves of each tower are connected longitudinally by a pair of deep double-webbed plate girders of special design. Two steel ladders up each tower, fixed to two of the shore legs, provide access to gangways on the superstructure.

The transporter car of this bridge is not suspended in the usual manner, but by a rigid trussed frame from an overhead trolley having four sets of eight-wheeled bogies. The bogies run upon rails supported on special rail bearer girders slung from the cross-girders of the superstructure. The trolley is hauled by a steel wire rope led over pulleys at the ends of the main girders, from the winding drum in the machinery house, a cabin carried on the shore legs of one of the towers. Powerful brakes are provided, and overhead buffers at each end come into play at the same time as those that stop the transporter car. The car crosses the river at a height of 18 ft. 10½ in. and takes only one minute to pass from shore to shore.

Another large transporter bridge is in use at Bizerta, a seaport in Tunis, North Africa. This structure provides a clearance to shipping of 149 ft. 3 in. above mean water level.

In 1905 a transporter bridge was erected at Duluth, a port at the western end of Lake Superior, Minnesota. It gave a clearance above high water level of 135 ft., and the transporter car was suspended from a rigid steel frame in a similar manner to the car of the Riachuelo transporter bridge. It was replaced in 1931 by a vertical lift structure, carrying a roadway 25 ft. wide, and flanked by footpaths 5 ft. wide.

The Brooklands Track



A view of a portion of the famous Brooklands racing track with a car at full speed. The photograph gives a good idea of the high banking that is necessary to make it possible for extremely high speeds to be achieved with safety.

Air Line Companies—

(*Continued from page 511*)

Atlantic by way of the British Isles and North France would be impracticable in winter.

Owing to the large number of air services operated by the Deutsche Luft Hansa, the company have pursued a policy of using a comparatively large number of different types of machines. The main types, however, are constructed by such firms of international repute as Dornier-Metallbauten G. m. b. H., Focke-Wulf Flugzeugbau A.G., Junkers Flugzeugwerke A.G., and Rohrbach-Metall-Flugzeugbau G.m.b.H.

On page 972 of our December issue, 1931, we published an illustrated description of the Junkers G.38, which is the world's largest landplane, and is probably the most interesting of the aeroplanes in the Luft Hansa fleet. In the summer of 1931, this machine was put into regular service on the Berlin-Amsterdam-London route, and was so successful in operation that another aeroplane of the same type has now been constructed. The new machine is slightly different from the older one, and is capable of seating 34 people. It is provided with four Junkers L.88 engines, which have a total horse power of 2,600 or 400 h.p. more than the older machine. It has a span of 144 ft. 4 in., is 75 ft. 6 in. in length and 23 ft. 7 in. in height, and weighs 16 tons empty. The loaded weight is 23½ tons. The machine has a maximum speed of 141.5 m.p.h., cruises at 115 m.p.h., and has a landing speed of 58 m.p.h.

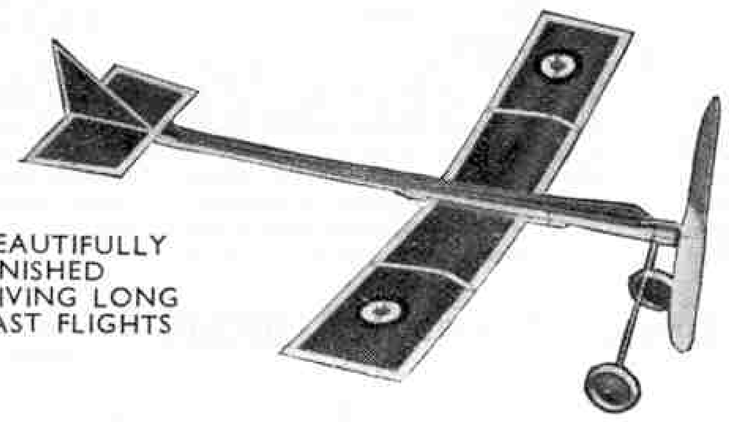
Junior Section—(*Continued from page 545*)

moves off slowly along the main line. The wagon will begin to move as the slack in the cable is taken up, and if the points have been set for the siding after the passage of the engine, the wagon will enter the siding and can be left in the required position. Such towing operations are quite possible in miniature, using Meccano Spring Cord, or even ordinary string, for the cable. This should not be less than 9 in. in length, or the sideways pull will tend to overturn the vehicle. A scheme of this kind will be found useful where space is limited, and a loop siding connected to the main line by facing and trailing points cannot be installed.

Trains in the trailing direction can of course easily leave wagons in the siding. They should be attached next to the engine and may be backed in, after being uncoupled and drawn forward from the rest of the train halted close to the points.

For the movement of odd wagons in a small yard horses are sometimes employed. These animals are splendid specimens of their kind, and older readers may recall the L.N.E.R. shunting horse at Welwyn, mentioned in the "*M.M.*" for June, 1927. Those model railway owners who, quite rightly, object to pushing odd vehicles along by hand, yet have not a spare locomotive available for such work, may therefore harness up a miniature horse for the job. If a suitable model draught horse ready harnessed is not available, one of the horses of Modelled Miniatures No. 2 may be provided with suitable traces made from elastic bands. One of our photographs shows the scheme. A long band is secured, by Seccotine if required, lengthways round the horse's body and neck, and a shorter band is doubled round him as shown in the illustration. The horse may be "coupled up" by means of fine chain, or a miniature "loop" made of suitable string.

HAVE A "FLYING" HOLIDAY THIS YEAR!



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Speed, 15 m.p.h. Ceiling, 50 feet.

Rises from the ground.

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EXTRA STRENGTH 1/1 half-bottle

KIA-ORA

LEMON ORANGE
GRAPE FRUIT

A MOVING REASON

Father (reading from paper): "In some parts of Africa the natives only wash once a year."

Son: "Let's move to Africa, dad."

* * * *

Brown-Brown (proud of his lineage): "If you can run in to-morrow evening I'll show you my family tree."

Plain Smith: "Sorry, but I've promised to look at Thomson's cabbages."

* * * *

"I want a cheap coat-hanger."

"Yes, sir, we have one at twopence."

"Twopence! Is there nothing cheaper?"

"Yes, sir, we have a nail at a halfpenny."

* * * *

Diner: "Waiter, the portions seem to have got a lot smaller lately."

Waiter: "Just an optical illusion, sir. Now that the restaurant has been enlarged they look smaller!"

* * * *

Father and son were enjoying an afternoon in the country.

"Just fancy," said the father pointing around him, "at one time these fields were covered by the sea, and fish were swimming about on the very spot where we stand."

"Yes, papa," said the little son suddenly stooping. "Here's an empty salmon tin!"

* * * *

Occupant of ground-floor flat: "The man in the top flat has a lot of correspondence, postman. You always have something for him."

Postman: "Yes, I had a row with him eight years ago, and ever since he has sent himself a postcard every day because I have to climb five flights of stairs to deliver it."

* * * *

"Billy says his father could wipe the floor with you Dad."

"Ah, you didn't let him get away with that I hope?"

"No fear. I told him to bring his father round to-morrow and prove it."

* * * *

"If you spend so much time at golf you won't have anything laid aside for a rainy day."

"Won't I? My desk is loaded up with work that I've put aside for a rainy day."

* * * *

NOT SO GREEN

Yokel (to old Salt): "'Ow do 'ee get the boats down to the water."

Old Salt: "We don't. We waits till the tide comes up and floats them off."

Yokel: "Well, oi may be a countryman, but oi'm not so green as to be took in by a tale like that."

HEAD THEORY

In a village cricket match the batsman was hit on the head with the ball, which glanced off and was caught by the wicketkeeper.

"How's that?" he yelled.

"Out!" said the umpire.

"But it hit me on the head!" protested the batsman.

"I don't care where it hit you," retorted the umpire, "I knows the sound of wood, so out you go."

* * * *

FOR DUAL PURPOSES

Undersized Man (trying on very large overcoat): "I can't wear this coat, Mary; it's much too big for me."

Wife: "I can't help that, John. Remember it's got to go over the radiator of the car in cold weather, and that's what we've got to consider first."

* * * *

"Haven't seen Bob for nearly twenty years. Does he still part his hair in the middle?"

"Oh, yes, but the parting is about five inches wide now."

* * * *

A farming expert was riding along a country road when he came up with a boy leisurely driving a number of pigs.

"Where are you driving the pigs to?" asked the rider.

"Out to pasture 'em a bit; to fatten 'em."

"Isn't it pretty slow work to fatten them on grass? Where I come from we pen them up and feed them on corn. It saves a lot of time," said the expert.

"Yes, I suppose so," drawled the lad, "but what's time to a pig?"

* * * *

The captain of an Atlantic liner was bothered by a woman passenger who was always enquiring about the possibilities of seeing a whale.

"But, madam," he demanded at last, "why are you so eager to see a whale?"

"Captain," she answered, "my desire in life is to see a whale blubber. It must be so impressive to watch such an enormous creature cry!"

* * * *

Policeman: "Why do you salute me, I'm not your superior officer."

Boy Scout (new and proud): "I know that, but you'll do to practise on."

* * * *

A clergyman was making his annual visit to the convicts in the city prison. To one man who looked very miserable he said:

"And why are you here, my man?"

The convict raised a mournful face. "Only for just one small thing," he replied.

"What is that?"

"They've got all the doors locked," came the reply.

DID HE KNOW?

"Does the foreman know the trench has fallen in?" asked the master of works.

"Well, sir," replied the navvy, "we be digging him out to tell him."

* * * *

The one train that called at Slocombe each day was the pride of the inhabitants.

"You're early to-day," said a farmer to the guard of the train.

"Yes," explained the guard, "we had the wind behind us."

* * * *

Actor: "Ah, my boy, when I played Hamlet the audience took 20 minutes to leave the theatre."

Bored friend: "Was he lame or something?"

* * * *

The giant liner was ploughing its way across the Atlantic Ocean. Near the bridge stood a rather nervous-looking passenger who, when the captain came out on deck, went up and touched him on the shoulder.

"Could you put my mind at ease, captain?" she asked.

"What is it?" asked the captain.

"Well," said the passenger, "what would happen if the ship struck an iceberg?"

"The iceberg would go on as if nothing had happened," replied the captain.

"Oh, thank you, captain," said the passenger "I feel much relieved now."

* * * *

Courteous Motorist: "Can I help you at all?"

Lady Driver: "It's this petrol indicator. It's at the half-way mark, and for the life of me I can't remember whether it means the tank is half full or half empty."

* * * *

"Don't you think it's very appropriate?"

"What?"

"To have a worm drive on a caterpillar track."

* * * *

First Camper: "I slept like a top last night."

Second Camper: "Yes; like a humming top."

* * * *

NOT IN THE PROFESSION

Tramp (watching party of campers at their morning toilet): "Come on, Bill. They're bloomin' amateurs. Look at 'em washing."

* * * *

"Hang it, man! If your car has been stolen, why don't you communicate with the police?"

"I'm not worrying about the car, I'm wondering how they got the thing to go!"

* * * *

Mrs. Bodger was pleased with the half-crown she had earned by posing for an artist, but for her employer she had nothing but contempt. "Artists!" she grumbled. "Artists is barmy. Asked me to sit for 'im, 'e did, and, when I went to 'is stoodio, blest if 'e didn't keep me standing for a 'ole hour."

* * * *

Teacher: "Name a liquid that won't freeze."

Bright Boy: "Hot water."

Be well groomed not gummed!

- BRYLCREEM does not contain Gum, and cannot cause flake in the hair, or set it hard—yet it controls the hair perfectly.
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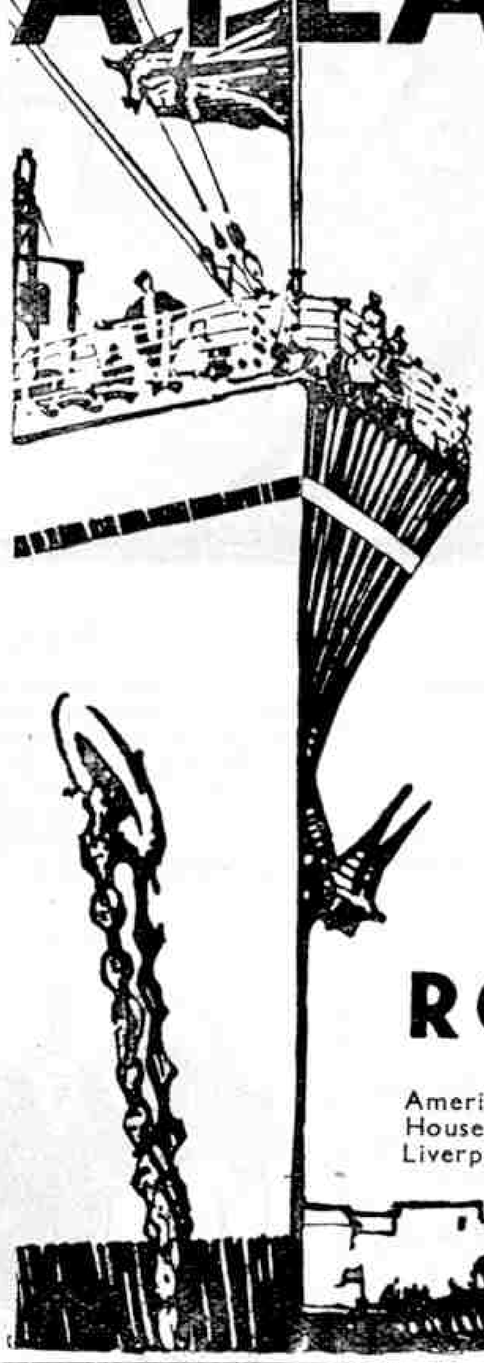

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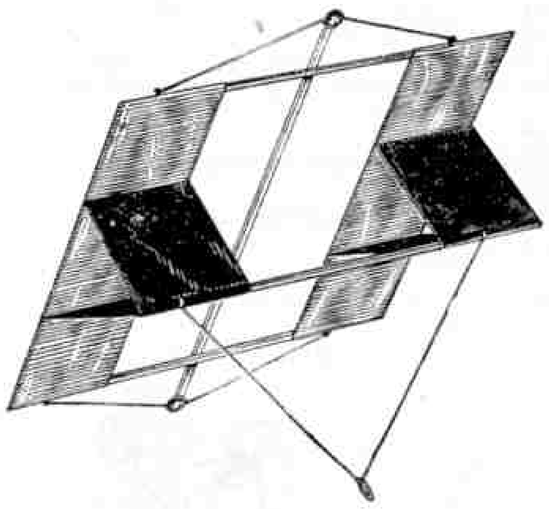

GAMAGES 'ALTIKITE'

This Kite is a great flier and has been specially built for Gamages. Note the size, 25 ins. × 25 ins. It is undoubtedly the best value ever offered at the price. Price **2/-** Post 6d.

Just the Boat for Your Holidays

A Fine Rubber Boat offered at the lowest price on record

Here is a really well made Rubber Boat at the lowest price ever. Ideal for surf bathing. Made in exceptionally heavy rubber, in assorted colours. Towing rope attached. Note the large size—36 ins. long. Inflated in a jiffy. *Foreign.* Price only **7/6** Post 9d.

MODEL SEARCHLIGHT

A fine new model that will throw a beam of light 40 feet in the air. Just like the real thing. Strongly made and finished in black. Replaceable battery fits in base—out of sight. Dimensions: Height to top of light, 4½ ins. Size of base, 4 ins. × 3 ins. Diameter of lens, 2 ins. Price complete with battery **3/9** Post 6d.

WORKING MODEL TELEPHONE

This new Chad Valley model is a perfect replica of the latest type of Post Office Public Telephone. It consists of a polished Bakelite Pedestal and Telephone, and the Signalling Buzzer is housed inside the pedestal. Calling is entirely automatic; immediately the instrument is removed from its base the signal is given by the distant set. Although an ordinary pocket battery is all that is required, this wonderful set will give telephone communication up to one mile. Battery 4½d. extra. Price **25/6** Post 1/-.
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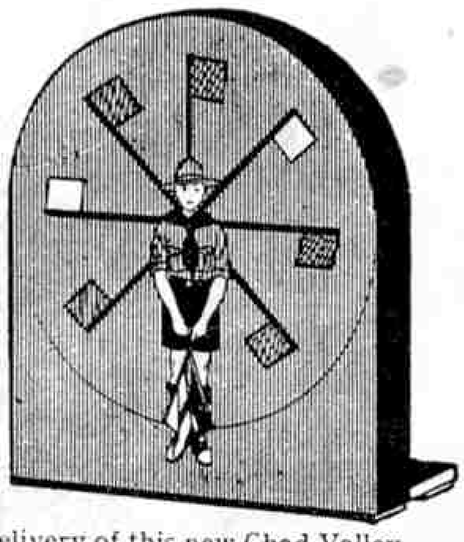

Gamages have received the first delivery of this new Chad Valley electrical toy. It consists of a frame with the figure of a Scout printed upon it. At the back is a board bearing a number of metal studs, each of which represents a letter or symbol in the semaphore code. The operator simply touches with a terminal the stud required which is indicated by a printed letter, and the correct flags are illuminated. An ordinary pocket battery is used. Price **7/6** Post 6d.
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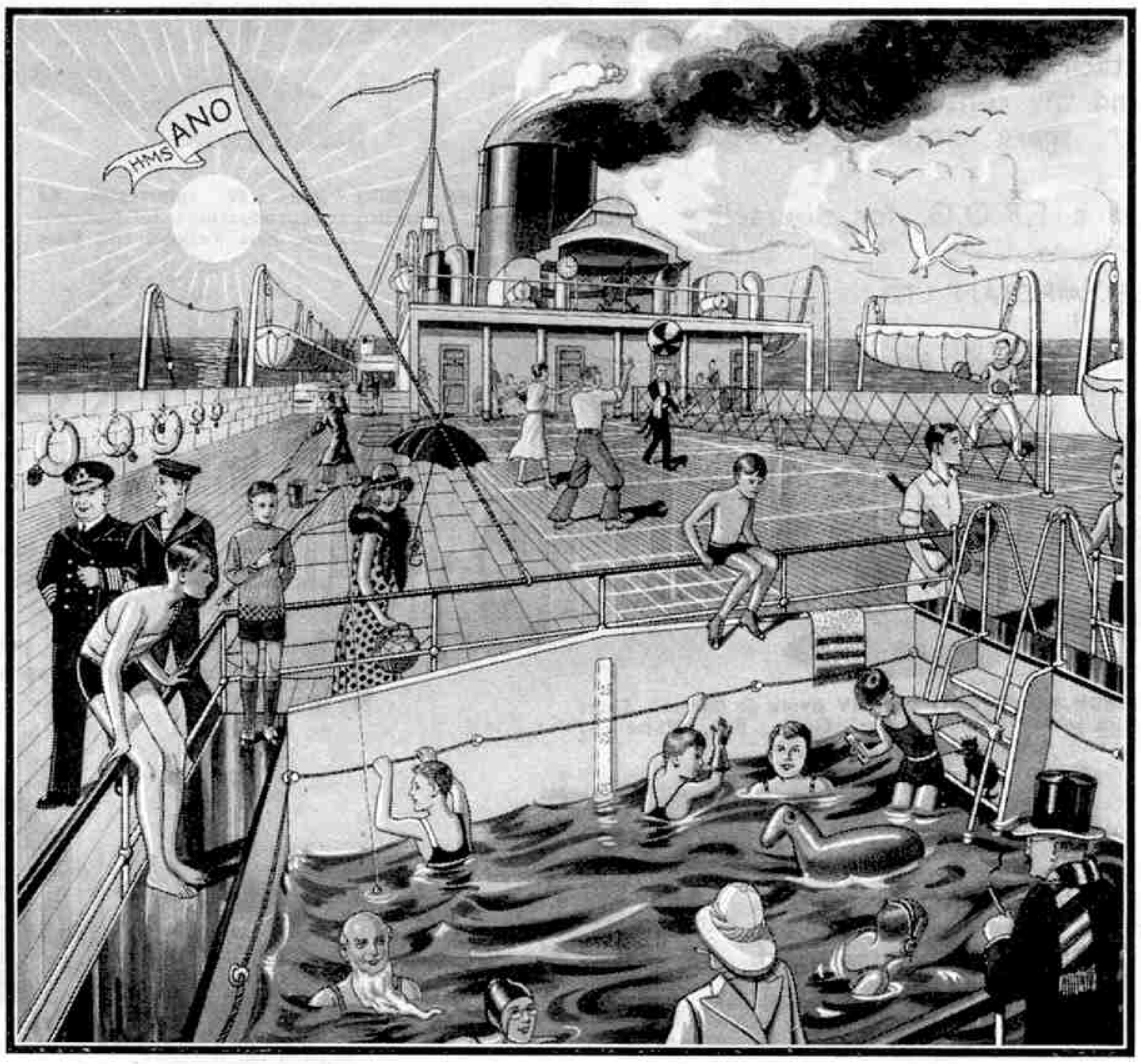
Competition Corner

JULY SHARP EYES CONTEST

The great popularity of sea cruising was the feature of the 1932 holiday season, and this year bids fair to create new records in this class of liner traffic. With a view to being topical we asked our artist to draw a picture of the sports deck of a holiday cruising liner, and the outcome of his efforts is shown here. Life aboard ship is certainly jolly if our artist's idea of it is to be accepted!



The drawing is bristling with errors, and the task our readers are invited to tackle is to discover as many of these errors as possible and make a list of them.

Readers may set about the competition in any way they please, of course, but we must emphasise the importance of being systematic. Many of the errors are obvious, but others are more subtle and require a good deal of ferreting out. The best plan in our opinion is to divide the picture up into sections, and examine each one minutely, jotting down the errors found, and exhausting its possibilities before passing on to the next.

Prizes of Meccano products, to be selected from the current catalogues by the winners, to the value of 21/–, 15/–, 10/6, and 5/–, will be awarded to the senders of the four longest lists of genuine errors. In addition there will be a number of consolation prizes for the next longest lists. In judging the competition one point will be allowed for each correctly claimed error, and one point deducted for each incorrect claim. In the event of a tie for any or all of the prizes, preference will be given to the neatest or most novelly prepared entry.

The lists of mistakes must be written on one side of the paper only, individual sheets must be fastened securely to one another, and the competitor's name and full address, together with the total number of errors found, must appear at the head of the first sheet. Entries should be addressed to "Holiday Cruise Errors, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st July. A duplicate set of prizes is reserved for Overseas competitors, whose entries must arrive not later than 31st October.

July Photographic Contest

As we announced in our April issue, our monthly photographic contests are open for photographs of any subject, made with cameras, films, plates, or paper of any make or size. The only restrictions are that each print must bear a title and that the exposure shall have been made by the competitor. The developing and printing may have been done professionally, but in the event of a tie for any of the prizes, preference will be given to prints that are solely the work of the competitor.

The entries will be divided into two sections, A for those from readers aged 16 and over, B for those under 16, and in each section there will be prizes of photographic materials, or Meccano products, to the value of 21/– and 10/6 for the best and second best entry respectively. A duplicate set of prizes will be reserved for Overseas competitors.

Competitors may submit as many prints as they desire, but no competitor can win more than one prize. It is important that every print sent in should have on the back the entrant's name, age and address, in addition to the title.

Entries to this month's contest must be addressed "July Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must reach this office not later than 31st July. Overseas closing date, 31st October.

Unsuccessful entries can only be returned if a stamped addressed cover of sufficient size is sent for the purpose.

COMPETITION RESULTS

HOME

February Drawing Contest.—First Prizes: Section A, H. H. G. DAVIS (Bristol); Section B, L. TIPLER (Tipton). Second Prizes: Section A, L. S. HILL (Southall); Section B, T. R. SIMM (Charlton, S.E.). Consolation Prizes: T. CROSBY (Blackpool); D. HAYWARD (Wolverhampton); J. H. MARSHALL (North Shields); C. F. MORROW (Palmers Green, N.13); G. E. PAGE (Jarrow-on-Tyne); R. B. ROLFE (Diss); A. L. WARING (Budleigh Salterton).

April Photo Contest.—First Prizes: Section A, S. GARBUTT (Altrincham); Section B, P. CLARKE (East Sheen, S.W.14). Second Prizes: Section A, W. M. HUNTER (Lewisham); Section B, V. D. KHAMBATA (North Kensington, W.10).

March Drawing Contest.—First Prizes: Section A, T. CROSBY (Blackpool); Section B, S. BOURNE (Weybridge); Section C, J. S. TAYLOR (Burnley). Second Prizes: Section A, A. E. LUKEY (Camden Town, N.W.1); Section B, T. R. SIMM (Charlton, S.E.7); Section C, K. E. ANNING (Ilkley). Special Prize: Section A, R. C. STORRAR (Letham Ladybank).

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Get more fun this holiday with a F.R.O.G. Mark IV Model Aeroplane. Learn to make it do the stunts of which it is capable so that you can qualify for the handsome proficiency badges that can be won.

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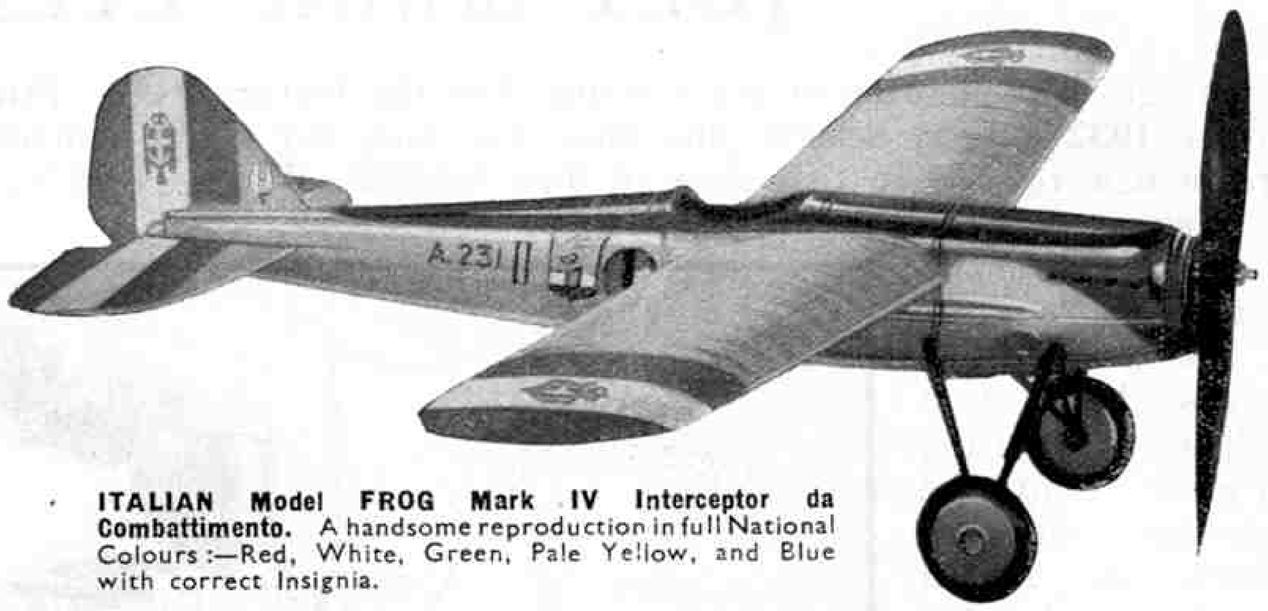

ITALIAN Model FROG Mark IV Interceptor da Combattimento. A handsome reproduction in full National Colours:—Red, White, Green, Pale Yellow, and Blue with correct Insignia.

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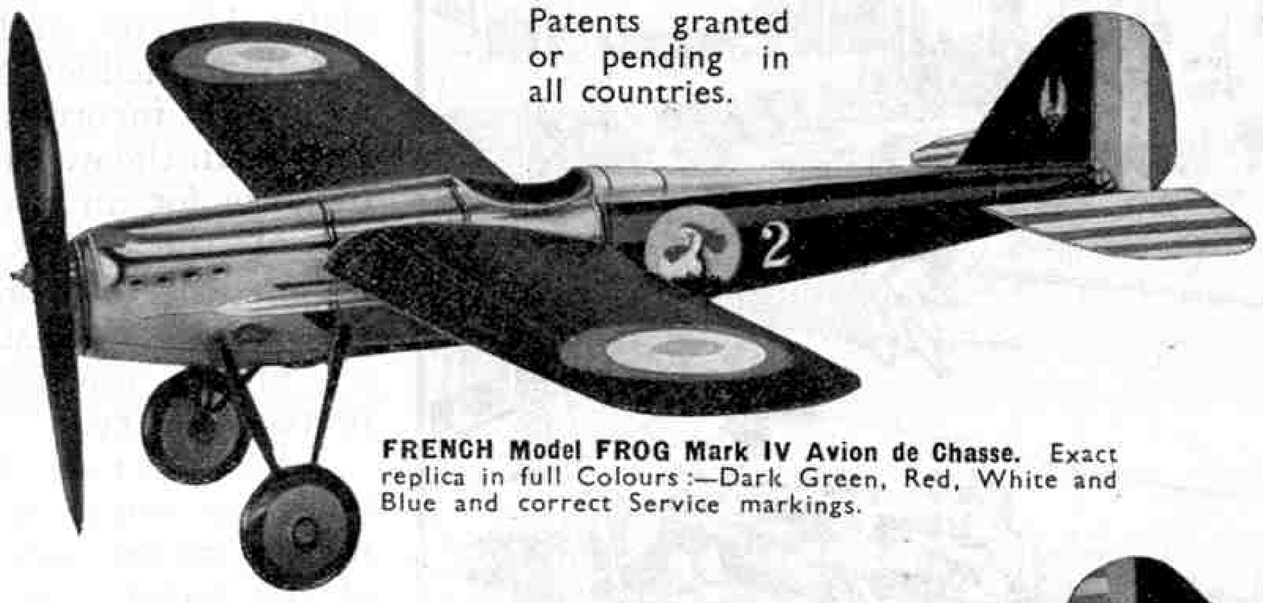

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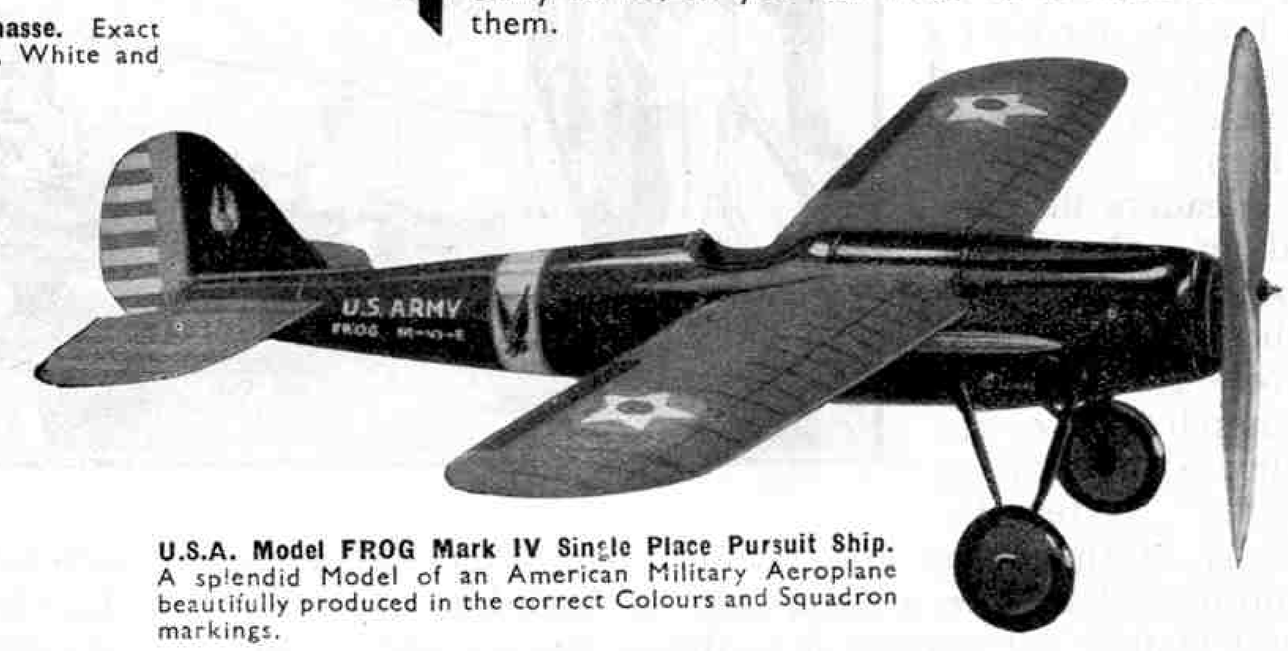
Your dealer will give you full particulars and entry forms, or you can write to us direct for them.



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Overall Length	9½ in.
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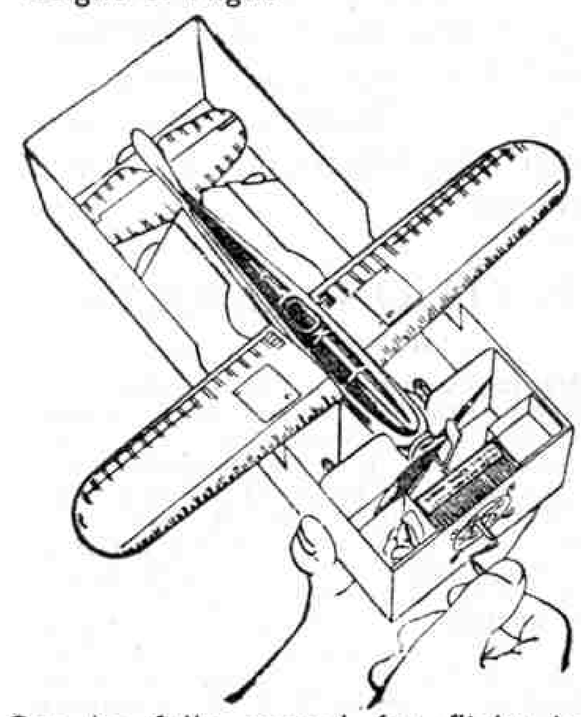
Normal Flying Speed	650 feet per min.
Length of Flight	300 feet
Height of Flight	70 feet



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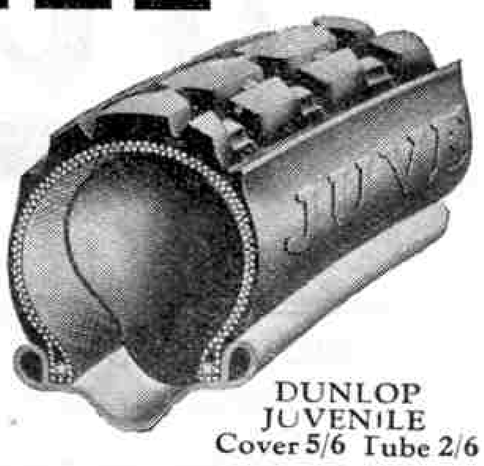

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Cover 5/6 Tube 2/6

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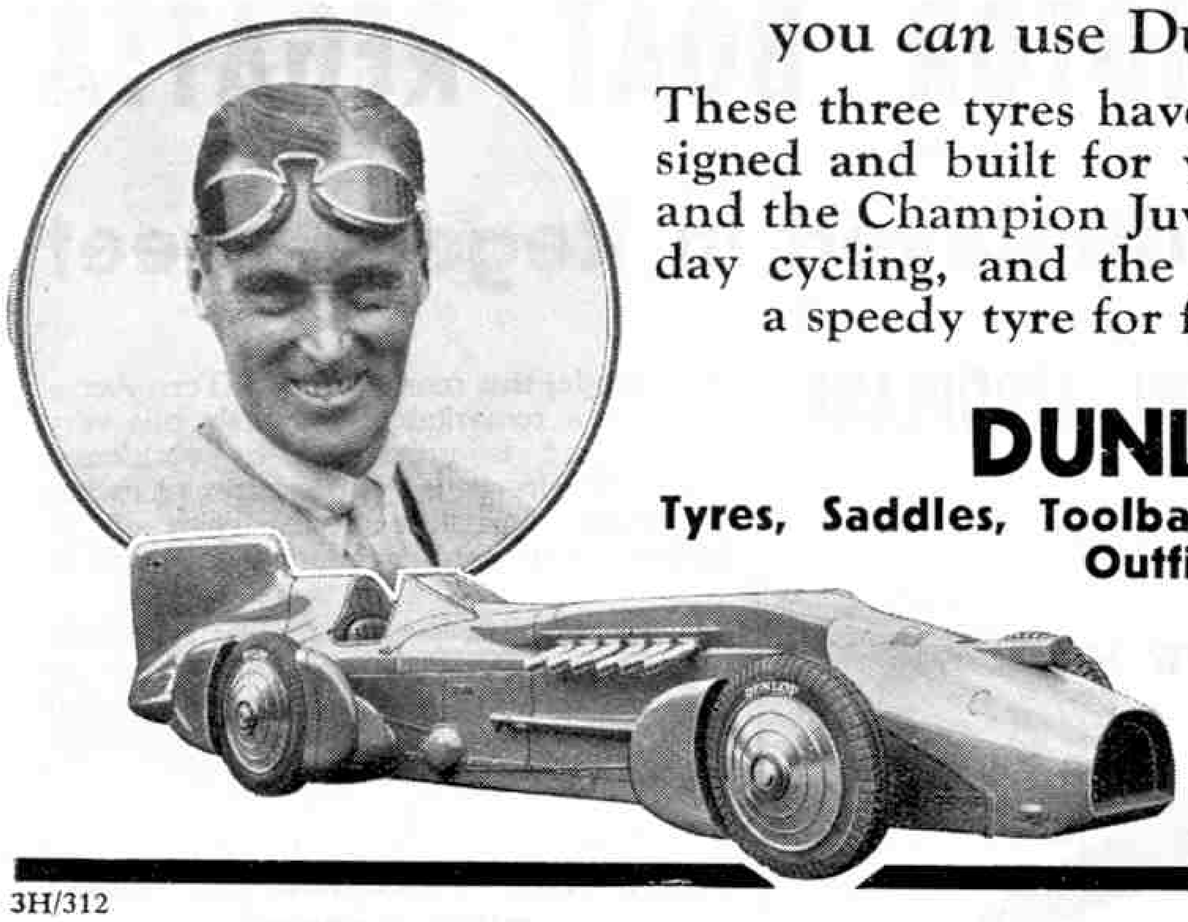

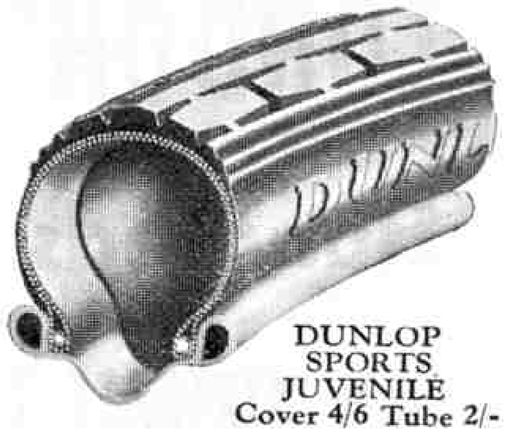

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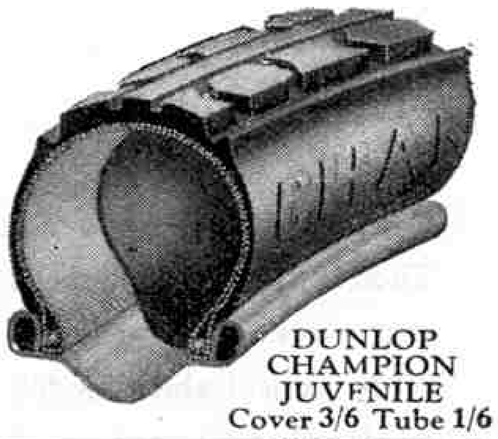

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FORT DUNLOP, BIRMINGHAM.
Branches throughout the World.

DUNLOP CHAMPION JUVENILE
Cover 3/6 Tube 1/6

3H/312 C.F.H.

LOTT'S CHEMISTRY

There are hours of really interesting experimenting ahead of the Boy who possesses a box of Lott's Chemistry. Each set contains Chemicals, Apparatus, etc., and an illustrated booklet of the experiments which can be carried out. Spare supplies of the Chemicals and Apparatus can be obtained.

Obtainable from all Leading Toy Dealers and Stores

SOME EXTRACTS FROM LOTT'S CHEMISTRY EXPERIMENTS

BOX 3. In this experiment a colourless solution should give a beautiful deep blue colour very suddenly, like a flash, but, as you cannot weigh out exact quantities, you may have to make a few trials, before you can get the colour to appear in a convenient time. . . . When you have got a reasonable time (say 20 to 60 seconds), you will be able to repeat the experiment in front of your friends and surprise them by forecasting the exact time of appearance of the blue colour.

Put one drop of turpentine on a piece of blotting paper and plunge it into the chlorine. It will catch fire and burn with a dense smoke. This is because the liquid and the gas combine so energetically and give out so much heat that the blotting paper catches fire.

BOX 4. Add this solution to the silver solution, shake the mixture, and immerse the tube to below the level of the solution in a mug of hot but not boiling water, rotating the tube at intervals. In a few minutes the solution will go cloudy and a yellow precipitate will begin to form, changing slowly to black, and then depositing in the form of a brilliant mirror.

Box 4. Price 15/6

BRITISH MADE

BOX 4 As illustrated above, contains 38 chemicals, Bunsen Burner, flask with rubber cork and delivery tube, porcelain crucible, glass funnel, three sizes of test tubes, wooden test-tube holder, tin dishes, filter papers, litmus paper, magnesium ribbon, glass tubing, test-tube cleaning brush and booklet of 181 experiments. Price **15/6**

In addition to Box 4 there are other sizes at **3/6**, **6/-**, **10/6**, **21/-**, **31/6**, and **42/-**. Also large cabinets at **73/6** and **105/-**.

These prices apply only in Great Britain and Northern Ireland. Obtainable in South Africa at Stuttaford & Co. Ltd., Capetown; Canada at T. Eaton & Co., Toronto, H. Morgan & Co. Ltd., Montreal.

Write for Illustrated List to Dept. M.M. **LOTT'S BRICKS LTD., WATFORD, HERTS.**

Hamleys News

Estd. 1760.

200 REGENT STREET W.1

(SPECIAL MODELS AND GAMES SUPPLEMENT)

NUMBER 3 JULY, 1933

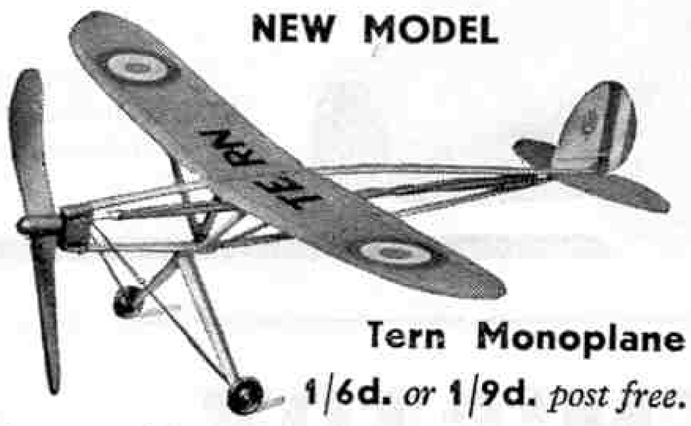
LONDON'S GRAND MOTOR BOAT REGATTA

Hundreds of New Craft displayed in Regent Street

NEW AIRCRAFT TYPES SEEN ON THE MODEL AEROPLANE FLYING GROUND

Would you like to see a model boat regatta? Then come to Hamleys in Regent Street next week, July 3rd to July 8th, where every conceivable model boat is being displayed and tested—yachts, speed boats, motor launches, battleships and a host of others. There was never anything like it before, boats of all sizes and types *and a pond on which you can try out any boat you like.*

NEW MODEL



Tern Monoplane

1/6d. *or* **1/9d.** *post free.*

A new Tern Monoplane on Hamleys Model Aeroplane Flying Ground. At 200 Regent Street they are demonstrating a new Model this month. The Tern Aeroplane is a remarkably fine little bus very robust and is unharmed by accidental immersion in water. It measures 14 inches in length, and has a wing span of 15 inches. You can have lots of fun with it.

Be sure and see the famous F.R.O.G. Flying Scale Model Aeroplane at Hamleys. They are now made in the full colours and with the correct markings of seven Nationalities.

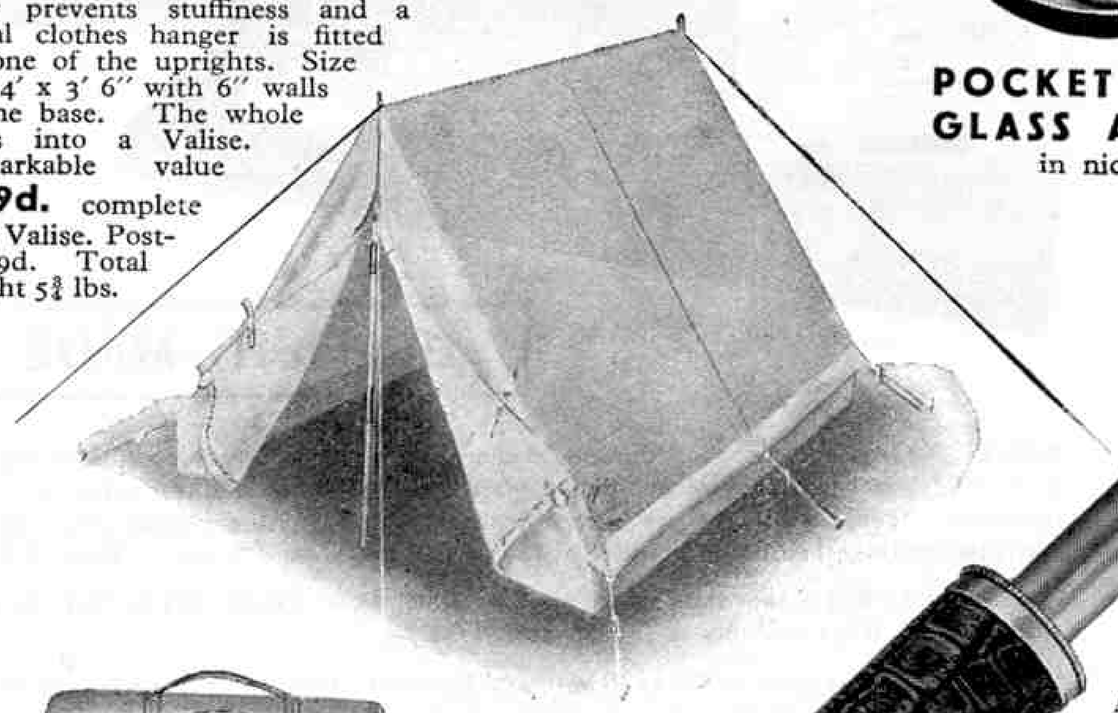
SWIMMING PRACTICE IN YOUR OWN GARDEN

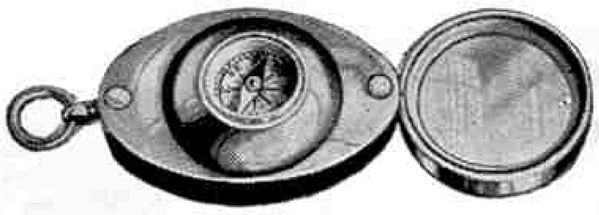
There is still time to have a swimming pool in your own garden. Take Father to Hamleys to see the SPORTAPOOL, which is filled by the ordinary garden hose and can be quickly emptied and stowed away or moved where you want it.

Get these in time for the Holidays, **Hamleys** *will post them to you.*

HIKER'S TENT

This closely woven waterproof Tent is made of white fabric and can be fixed in a moment, with two poles, each of which take apart into three pieces and are fitted with brass sockets. A patent ventilator prevents stuffiness and a metal clothes hanger is fitted on one of the uprights. Size 6′ x 4′ x 3′ 6″ with 6″ walls at the base. The whole folds into a Valise. Remarkable value **12/9d.** complete with Valise. Postage 9d. Total weight 5¾ lbs.





POCKET MAGNIFYING GLASS AND COMPASS

in nickel case 1½″ in length.
Price **1/3d.**
Postage 2d.

TELESCOPE

with Rexine Crocodile covered body and lacquered brass mounts. Length opened 4½″. Price in case **4/6d.** Postage 3d.

Also with polished body and lacquered brass mounts. Complete in case.

1 draw length open 5½″ Price **5/11d.**
2 draw „ „ 7¼″ „ **6/11d.**
3 draw „ „ 9¼″ „ **7/11d.**

FIRESTONE AIR BUOY.

What fun you can have bathing with this Air Buoy. It is made like a Car inner tube of strong rubber in a pleasing shade of green, and requires no pump to inflate it. 24″ diam. when inflated.
Price **5/-.** Postage 6d.

For all your summer holiday games and fun

Hamleys **200 REGENT STREET, LONDON, W.1.** *Our only address.*

Boys! make holidays— happy days by visiting

HALFORDS

There's a marvellous selection of better cycles, accessories and true-to-life models awaiting you at the nearest Halford Depot. Remember that at Halfords you can often get two or three articles for the price of one that is bought elsewhere, and the Halford article is always of the best quality.

The PATHFINDER MODEL

Chromium plated, with North Road Handlebars and the latest crossover lever brakes. The model for the speedsters.

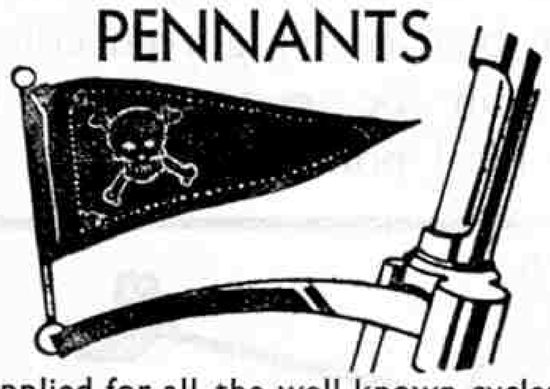
£4-5-0

GIRL'S MODEL

Chromium plated. An exceptionally smart easy running cycle—splendid value at

£4-7-0

PENNANTS



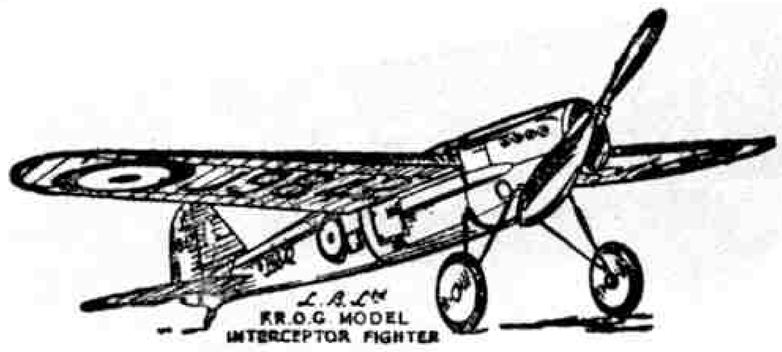
Supplied for all the well-known cycles. Also skull and crossbones and Union Jacks.

Nickel staff ... ... **7½d.**
Chromium **1/-**
Postage 2d.

Call at your nearest Halford Depot for our monster catalogue— it's FREE, or write

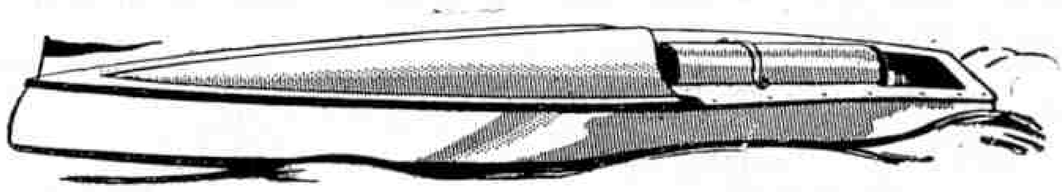
MECCANO OUTFITS
from **1/3**
SPARES always in stock.

HANDICRAFT OUTFITS
and TOOL SETS from **1/-**



F.R.O.G.
MODEL AEROPLANES
Various colours, **7/6**
Other types from **2/6** each.

SPEED BOATS
of latest design, very powerful and speedy. Prices from **5/-** each.



"HECTOR"
AIR GUNS
British make, **5/11**
Also Ammunition and Targets.

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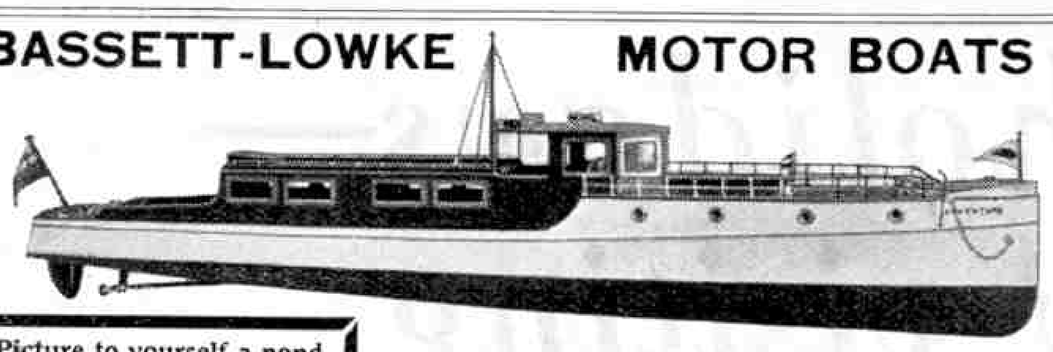
BASSETT-LOWKE MOTOR BOATS



Picture to yourself a pond, dotted with model boats, sails filling, motors humming.

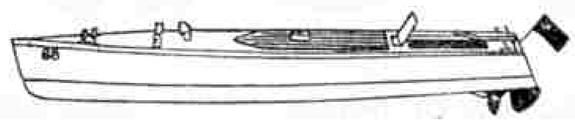
A motor boat puts out from the shore, the sun shining on brass and paintwork. Quickly getting into her stride she speeds away from the shore.

She is a Bassett-Lowke model and perhaps the famous "IOLANTHE," the pride of Bassett-Lowke's shipyards, as handsome as she is speedy, as British as the Red Ensign floating astern.

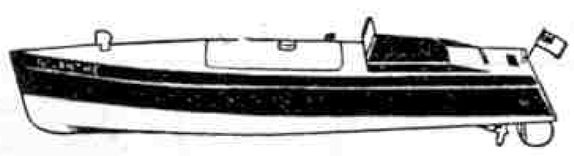
To obtain the utmost in speed and realism see that your motor boat, or model yacht, is made at Northampton, where all the famous BASSETT-LOWKE models are built.

You will want to know all about these new model boats, therefore send at once sixpence in stamps for Messrs. Bassett-Lowke's Ships List. Ask for S.17. Not only does it contain particulars of Sailing Boats, Motor Boats of every description, but fittings for Model Boat and Ship Builders from a stanchion to a scale model winch. Written by Naval Experts and profusely illustrated with line diagrams and half-tone blocks. New edition now ready.

Model Cabin Cruiser, "Adventure."
A magnificent model of a popular type of fast motor cruising yachts. Propelled by a powerful electric motor and driven by dry batteries, or accumulators, if required. Best quality pine hand-carved hull, finished and varnished, all fittings, plates and port and starboard lights, illuminated by a dry battery. A most attractive and serviceable motor boat. Length, 3 ft. 3 in., beam, 6½ in.
Price **£12 12 0**



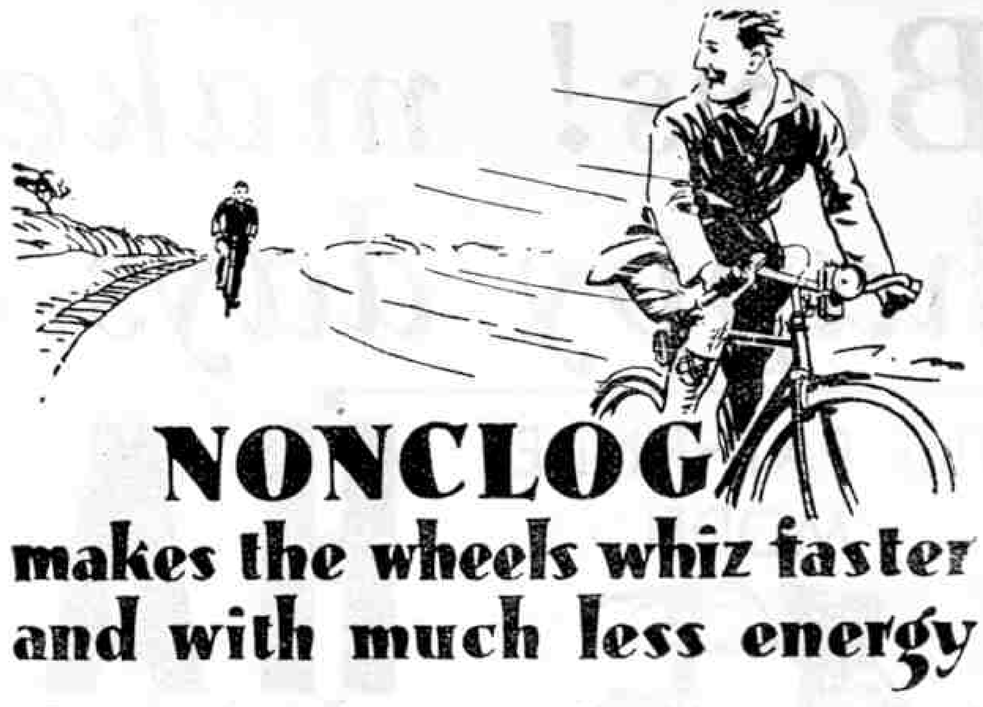
Motor Boat No. 88.
An exceptionally smart and attractive model, with either clockwork mechanism or Permag motor, finished in white with blue and orange lines. Length, 21 in., beam 3¾ in. Clockwork.
Price **£1 1 0.** Electric **£1 5 0**



Super Motor Boat, "Iolanthe."
A high-class production throughout. The power units incorporate all the latest features. Finished in black and white, or blue and white, with gold lines. Clockwork runs 6 minutes at one winding, and the electric model 2 hours on two dry batteries. Clockwork or electric. Price **£1 15 0.** With cabin and port and starboard lamps to light up. Electric model only. Price **£2 10 0**

BASSETT-LOWKE LTD., NORTHAMPTON

London Branch: 112, High Holborn, W.C.1. Manchester Branch: 28, Corperation St.



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makes the wheels whiz faster and with much less energy

GRADE A (Light) for ordinary use
6D. PER TIN

GRADE B (Heavy) for long distance riding and speed work.
7D. PER TIN

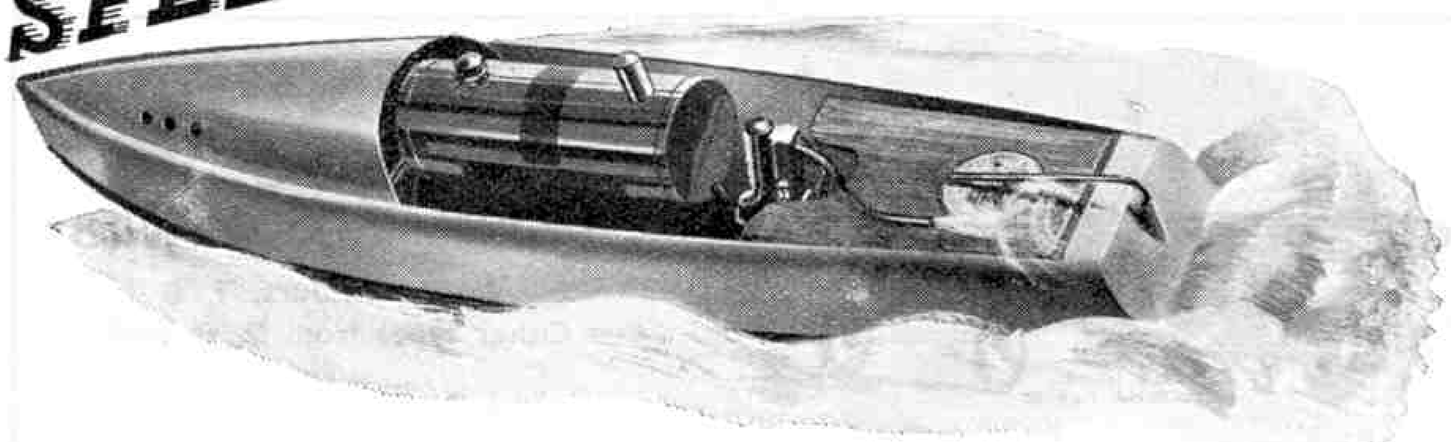
Ordinary cycle oils won't stand up to fast riding with modern cycles on fast roads. You're wasting your energy . . . . because of unsuitable lubrication.
Nonclog is the finest cycle oil in the world . . . because of higher viscosity it clings to bearings, reduces friction to a minimum, and remains efficient at highest speeds and over long distances. *Lubricate YOUR Cycle with Nonclog to-day . . . see the difference CORRECT LUBRICATION makes.*

NONCLOG
the CORRECT Cycle Lubricant

Obtainable from Halford's, Curry's and all cycle dealers.
THE COUNTY CHEMICAL CO. LTD., Chemico Works, Birmingham.

(Sells)

SPEED-SPEED-SPEED



"THE SWALLOW." Here's a real record-breaking craft—sleek, speedy and high powered. Represents the best value ever offered in this type of boat. Steams for 20 minutes on one filling.
Patent wood hull. Length, 20". Beam, 3½". Bowman Engine, ¾" stroke × ⅝" bore. Polished brass boiler, 4½" × 1½", with safety valve and overflow tap. Safety type lamp for methylated spirit. With filler and instructions in wood box. Postage U.K. 9d. **17/6**

"SEAHAWK." Length, 28" (Post 1/3) 42/-

"SNIPE." Length, 23" (Post 9d.) ... 22/6

"THE COMET." Patent wood hull and aluminium spray hood. Length, 30". Beam, 3½". Polished birch deck, tongued to represent boards, new high speed, long-running clockwork motor and starting lever. Polished cellulose finish. In strong wood box. Postage 1/-. **20/-**

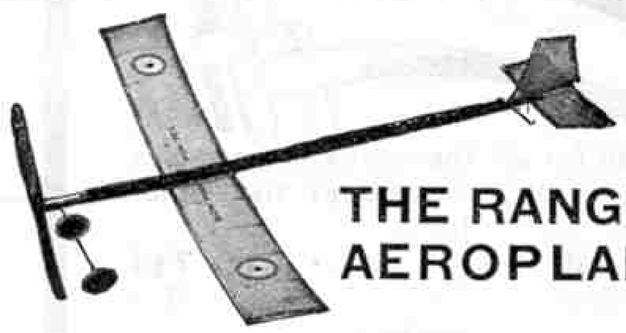
DASHING 'AEROBOATS' were the sensation in model boat circles last year. These long, rubber tension drive speedsters have been winning races on ponds all over Britain—from **1/3** to **17/6**

The marvellous rubber-driven "WHIRLWIND" Racer, 27" long, for **1/3**, is a really snappy speed boat. Postage 6d.

BOWMAN MODELS

Send 3d. in stamps for your copy of the beautifully illustrated Book of Bowman Models, to Bowman Models (Dept. M.M.21), Dereham, Norfolk.

Bowman boats, whether steam, clockwork or elastic-driven, are built to give you more pleasure, greater speeds, longer runs, better value for money than their rivals in any particular class. Boys! with a Bowman boat carrying your colours you'll soon be racing champion of your local pond.



THE RANGER AEROPLANE

THE "RANGER" AEROPLANE. Span, 24". Length, 24½". Propeller, 9½". Flies 650 feet. Best proofed silk-covered planes. Shock-proof chassis—aluminium wheels. Post free **4/6**

VORTEX 8'6 **VULCAN 6'6** **BULLET 2'6**

SUMMER-TIME is SELO-TIME!

When you are out with your camera, you cannot do better than load it with Selo, the fast film. You will not get disappointing "blanks"—for Selo is so fast that even with the most inexpensive camera you are sure of bright snaps.

SELO

The **FAST FILM**

For dull weather use SELOCHROME
the EXTRA-FAST FILM

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SKYBIRD LEAGUE

Have you started a Skybird Club and joined the SKYBIRD LEAGUE?

Add to your collection,

the conqueror of Mount Everest—the famous Westland "Wallace." Price **3**/- complete, with a metal Bristol "Pegasus" engine.

Another new model which you should not miss is the Cierva Autogiro C24 (made by special licence from the Cierva Company). Price **2**/**6**.

There are now 14 models in the Skybird series and others in preparation, also many new Aerodrome accessories, scale figures, etc.

Write for list and address of nearest agent.

A. J. HOLLADAY & CO. LTD.
(Desk B)
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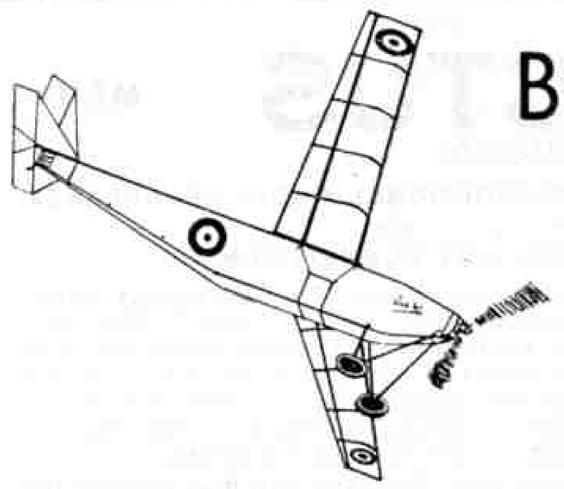


BOND'S Model Aeroplanes

Real Fuselage Flying Models

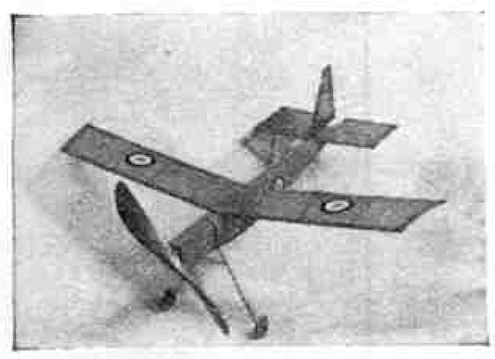
Get one of these British-Made Aeroplanes and show your friends what a real flying model should look like. Be up-to-date and have the correct thing. A Fuselage Model Aeroplane.

PRICES.

The "Flying Fury." Length, 16". Wing Span, 20". Rises from the ground and flies 450 ft. Price **5**/- post free.

FUSELAGE MODELS FITTED DUPLEX MOTORS. The "Juno." Length, 21". Wing Span, 26". Rises from the ground and flies 600 ft. Fitted Duplex geared motor. Price **12**/**6**, postage 9d.

The "Jupiter." Length, 26½". Wing Span, 36". Rises from the ground and flies 1,000 ft. Speed, 13½ m.p.h. Fitted Duplex geared motor. Conforms to Competition specifications. Price **15**/-, postage 9d.



The "Flying Fury" Aeroplane.

The "Superb." Similar size to above but fitted with rubber shock absorber under carriage and has a speed of 15 m.p.h. Price **17**/**6**, postage 9d.

Send for Bond's Model Catalogue, 6d post free or Bond's Free Cycle Catalogue.

BOND'S O' EUSTON ROAD LTD.,
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'Phone: Museum 7137. Estd. 1887.

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is the PROVED STRONGEST ADHESIVE in the WORLD!

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We don't ask you to take our word for it! Prove it for yourself. The Navy did! The Air Force did! *We* have proved it, too—Seccotine is more than *twice as strong as other adhesives.*

It is also very economical. You should use only a very little, by pressing the end of the tube *gently*. So used, Seccotine lasts for ages, and is cheapest as well as strongest.

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To: DEPT. M, McCAW, STEVENSON & ORR LTD., BELFAST.

I should like to have, post free, a copy of your Free Booklet.

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TRADE **XACTUS** MARK

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To All Builders of XACTUS CONSTRUCTIONAL MODEL AEROPLANES.

Enter now for the

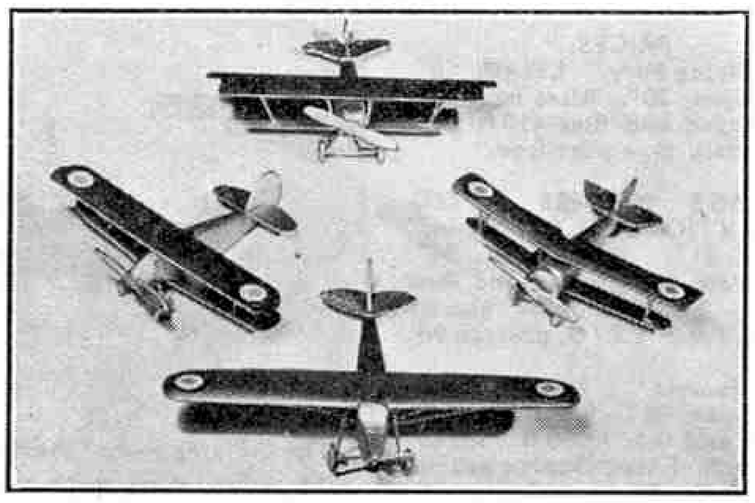
XACTUS SUMMER-TIME COMPETITION.

All you have to do is to build a minimum of four Xactus Machines, either from the 1/40th (2/6) Construction Sets, or from the 1/70th (6d.) Construction Sets, arrange them artistically, photograph them, and send a print to us together with the covers of the four boxes used, and the prizes for the best constructed and photographed Models will be :—

FIRST PRIZE ... £1 1s. 0d. SECOND PRIZE ... 15s. 0d.
THIRD PRIZE ... 10s. 0d. Six Consolation Prizes.

Start right away, buy the Sets from your Toy Shop, and bear in mind the closing date for this competition is AUGUST 31st, 1933.

The judging of the photographs is left to the Manufacturers, and their decision is final.



"FLYBIRDS."

New types now added to this series of Completed Models :—

AUT-GIRO. MARTYNSIDE. GYPSY MOTH.

Price 1/6, postage 3d.

Obtainable at all Toy Stores or direct from

THE XACTUS MODEL CO. 717, LONDON ROAD, THORNTON HEATH, SURREY.

Shops and Wholesalers for London and Southern England :—
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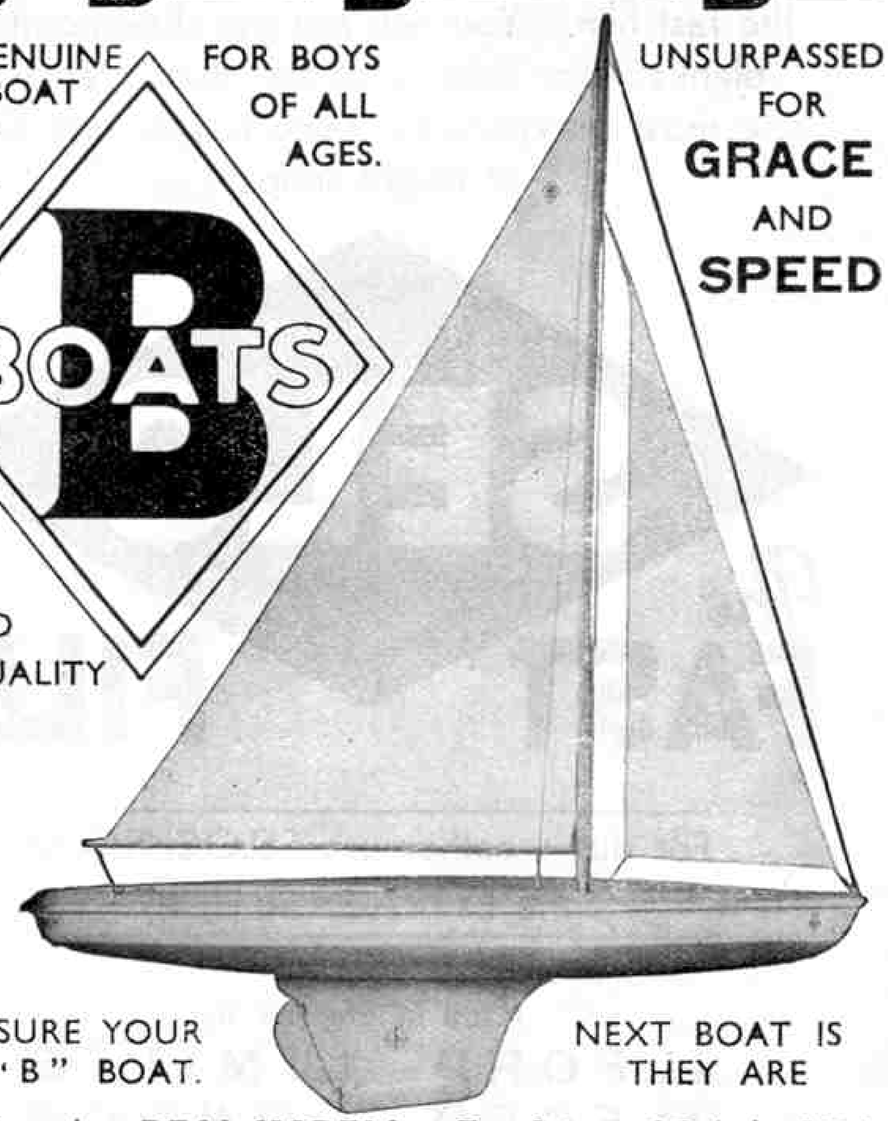
"B" BOATS BRITISH & BEST

THE GENUINE "B" BOAT BEARS THIS CREST

FOR BOYS OF ALL AGES.

UNSURPASSED FOR **GRACE** AND **SPEED**



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BE SURE YOUR A "B" BOAT.

NEXT BOAT IS THEY ARE

NOT Toys, but **REAL MODELS** at Toy Prices. **12/- to 45/-**

Write NOW for Illustrated Leaflet of

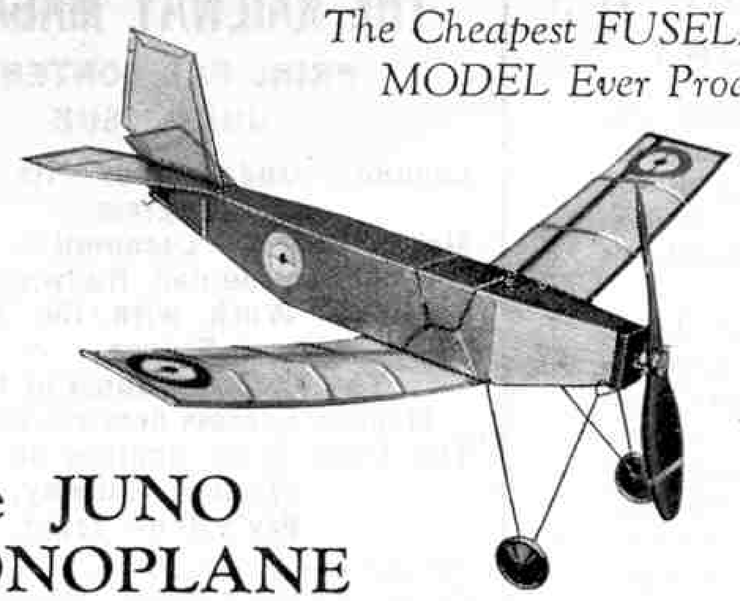
YACHTS, ELECTRIC and CLOCKWORK SPEEDBOATS

To Manufacturers :—

BRITISH YACHT & MODEL CO.

459, FULHAM ROAD, LONDON, S.W.10 'Phone: Flaxman 4811

The Cheapest FUSELAGE MODEL Ever Produced



The JUNO MONOPLANE

This beautifully finished Model has an outstanding performance. Will rise off the ground after a short run. It is perfectly stable in flight, even in strong winds. The fuselage is covered with silk and doped. Mainplane and tail unit covered proofed silk. Weight 3½ ozs., span 26", length 21¼". Will fly 30 seconds. Speed 14½ m.p.h.

Price **10/6** *Post Free*

OTHER FUSELAGE MODELS

THE SILVER HAWK Record: Duration 2 mins. 28 secs. Freewheel propeller. Weight 5½ ozs., span 36". Price **30/-** post free. (Construction Set **18/6** post free.)

THE SUPERB A splendid model, 36" span. Speed 15 m.p.h. Duplex geared motor. Weight 6 ozs. Rubber shock absorbers on rear undercarriage. Price **17/6** post free.

THE JUPITER Similar to above, but without shock absorbers. Price **15/-** post free.

THE MERCURY A fine model, 36" span. Speed 13½ m.p.h. Will fly 1,000 ft. Price **12/6** post free.

Send 1½d. stamp for Catalogues. We have over 20 Fuselage Models and Construction Sets to choose from at prices from 1/- upwards; also a large range of spar models.

MODEL AEROPLANES & TOYS LTD.,
NEWGATE STREET, NEWCASTLE-ON-TYNE, 1.

make 'em

HEAR *and* **SEE!**

Every cyclist should have these for safety. The new Pifco Horn supersedes bells. It has a loud high-pitched tone, long life and is completely weatherproof.
The Pifco Headlamp is recognised as the finest value obtainable, and by far the best looking cycle lamp. It has many unique features not found in other lamps whatever their price. Fit both the lamp and the horn. Add to your safety and make cycling more pleasurable at the same time.

PIFCO ELECTRIC CYCLE HORN
Fits any Cycle. Complete with three batteries. **7/8**

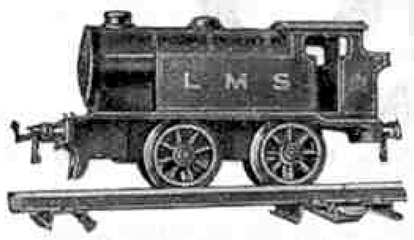
PIFCO ELECTRIC CYCLE LAMP
The only electric lamp with these features: 90 ft. beam. Faceted Lens. 30 hour light from two pocket batteries. Alternative voltage, 4 or 8 volt. **5/-**

PIFCO

PIFCO LTD., HIGH STREET, MANCHESTER, and
150, Charing Cross Road, W.C.2.

Genuine Pifco Products **ARE MARKED** *PIFCO*

HORNBY TANK LOCOMOTIVES



M3 Tank Locomotive

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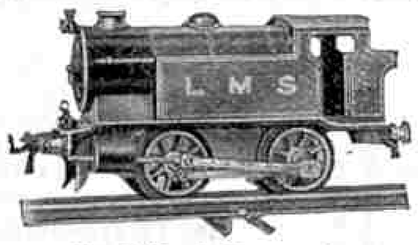
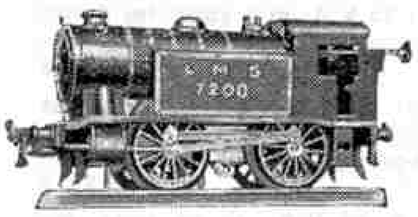
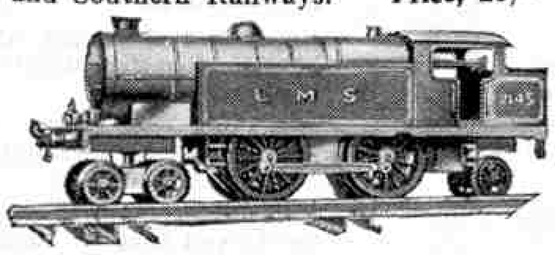


No. 1 Tank Locomotive



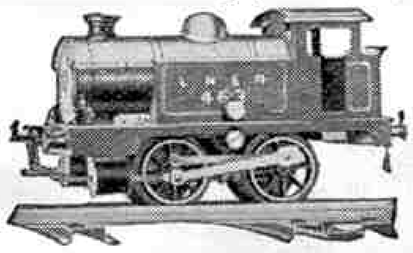
No. 1 Special Tank Locomotive

No. 1 SPECIAL TANK LOCOMOTIVE. This splendid Locomotive which is fitted with brake mechanism and reversing gear, has remarkable power and gives a very long run. It is available in the colours of the L.M.S., L.N.E., G.W. and Southern Railways. **Price, 18/-**



No. 2 Special Tank Locomotive

No. 2 SPECIAL TANK LOCOMOTIVE. This Locomotive has great length of run and exceptional pulling power. It is fitted with brake mechanism and reversing gear. In every respect it is a perfect model, beautifully finished in the colours of the L.M.S., L.N.E., G.W. and Southern Railways, **Price, 25/-**



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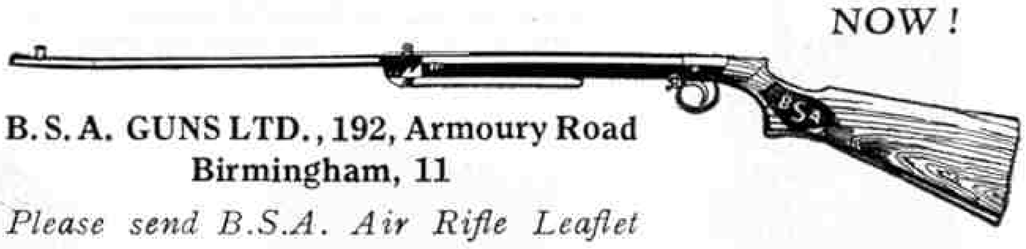

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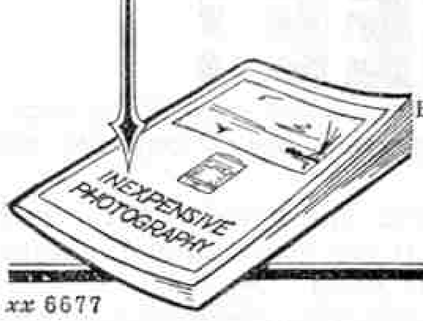

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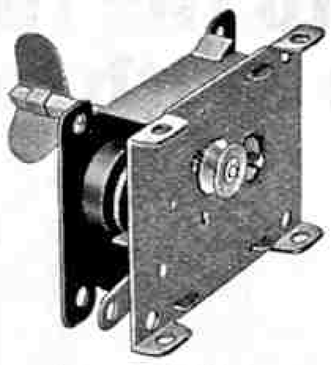

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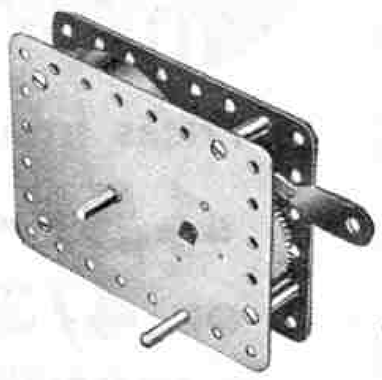

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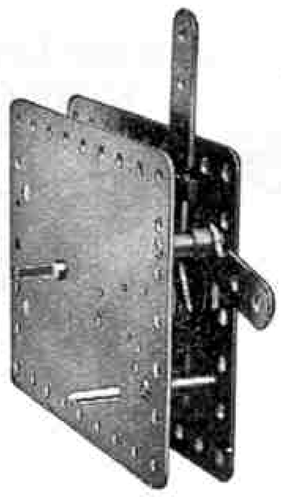

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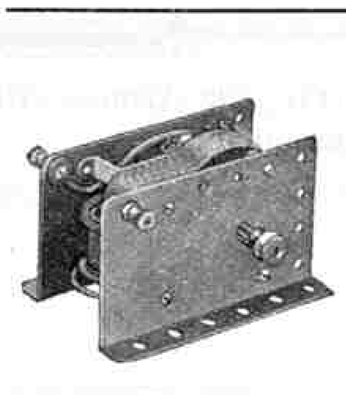

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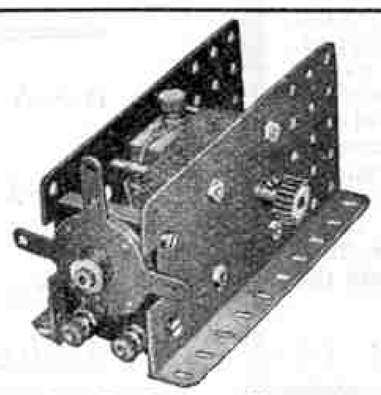
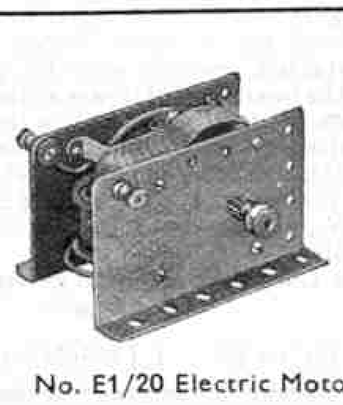


No. E6 Electric Motor



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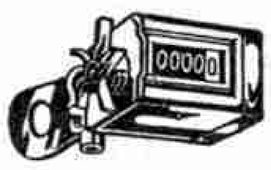

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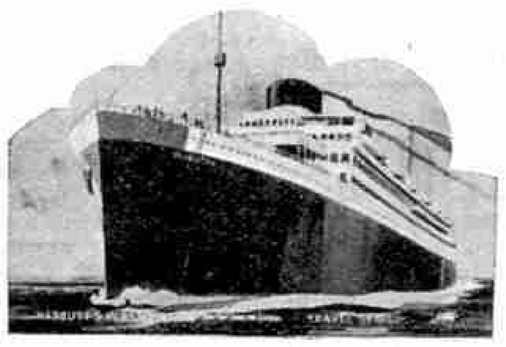

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Locomotive Economy—(*Cont. from page 521*)

time being fitted with apparatus of one kind or another. On the late L.N.W.R. a locomotive of the 4–4–0 "George the Fifth" class, No. 1471, "*Moorhen*," now L.M.S.R. No. 5371, was fitted with a Weir feed-water heater and pump, and this apparatus has been provided on a considerable number of engines on different railways here and abroad. Mr. W. Pickersgill fitted it on the Caledonian 4–4–0 locomotive No. 136 about 1920, while on the Midland Railway No. 768, a class "3" 4–4–0, was similarly fitted, and the system was also used on the Brighton line. More recently the "Dabeg" apparatus has been fitted to several engines, notably an L.M.S.R. 4–6–0 of Horwich pattern, No. 10434; and a similar experimental installation was provided on one of the G.N. section three-cylinder 2–8–0 locomotives of the L.N.E.R., No. 3500.

A system that is particularly in favour at the present time is known as the "A.C.F.I.," these letters being an abbreviation of the long name of the French engineering concern that is responsible for it, "L'Auxiliare des Chemins de Fer et de l'Industrie." This system has been applied to two of the famous "Pacifics," No. 2576, "*The White Knight*" and No. 2580, "*Sholover*," after some more or less experimental installations on G.E. and N.E. engines. In tests with the "Pacifics," the average temperature of the feed-water on delivery was found to be 225°Fah. Further G.E. engines have been fitted up recently, and the position of the water cylinder above the boiler has resulted in their being dubbed "The Hikers." This form of apparatus can be seen in the G.E. 0–6–0 illustrated in the lower photograph on page 520. The L.M.S.R. have also provided this system on three of their standard "G3" 0–8–0 coal engines, Nos. 9672–74.

Forms of feed-water heating apparatus such as this do not improve the beauty of the locomotive types to which they are adapted, as readers will no doubt agree after an inspection of our illustrations. For sheer strangeness in looks, however, probably nothing could excel those locomotives of the former L. & Y. Railway, which were fitted more than 20 years ago with what was known as the Druitt Halpin thermal storage apparatus that took the unusual form of a huge chamber or dome on the boiler barrel. The dome, of course, was the thermal storage tank. This system was not attended with any great degree of success, and its use was confined to the few engines that were experimentally fitted with it.

It is strange how some railways, after many years' use of a certain form of apparatus tending to economy in a certain direction, have as readily discontinued it later. Probably maintenance costs and the question of reliability have been the chief deciding factors against the use of any particular form of feed-water heating apparatus, but modern appliances seem satisfactory enough to ensure that the various systems should be given an extended trial.

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Famous British Admirals—(*Contd. from p. 497*)

hastily threw overboard their guns and stores to lighten their vessels so that these could escape up the shallow River Vilaine at high tide and thus get out of reach of Hawke's ships. They accomplished this, but the repeated grounding of the ships when the river was low seriously damaged most of them. Nine other French ships succeeded in escaping from the bay.

In the course of a long report to the Admiralty, Hawke wrote: "Our loss by the enemy is not considerable, for in the ships which are now with me, I find only one lieutenant and 39 seamen and marines killed, and about 202 wounded. When I considered the season of the year, the hard gales on the day of action, a flying enemy, the shortness of the day and the coast we were on, I can boldly affirm, that all that could possibly be done, has been done. . . Had we had but two hours more day-light, the whole had been totally destroyed or taken, for we were almost up with the van when night overtook us." The victory crushed the projected invasion of this country.

When Hawke arrived home on 17th January, 1760, he was given a great reception. Parliament thanked him for his services and awarded him £2,000 a year, and the King ordered a medal to be struck in celebration of the victory. Hawke was also elected one of the Elder Brethren of Trinity House, and shortly afterwards Dublin made him a freeman of that city. The strain of the six months' blockade and the stress of fighting a great battle in stormy weather and dangerous waters broke down his health, and he asked to be relieved of his command. The request was granted, and his place was taken by Boscawen, but Hawke was able to return to active service before the close of the year.

In May 1762 Hawke was sent to sea with nine ships to intercept a small French squadron that had escaped from Brest during a thick fog and was under orders to attack Newfoundland. A diligent search that lasted several weeks was carried out but the enemy were not encountered. When Hawke returned he was appointed to the command of a squadron of 10 sail of the line and three frigates, and ordered to proceed to Lisbon, which was threatened with attack by a combined French and Spanish force. The arrival of the English fleet at the mouth of the River Tagus deterred the enemy, and the intended attack was abandoned.

Between 1762 and 1766 successive promotions raised Hawke to the highest office in the British Navy. In October 1762 he was promoted to Admiral of the White, and two months later to Rear-Admiral of Great Britain. In 1765 he became Vice-Admiral, and in the next year he was appointed to the office of First Lord of the Admiralty, which position he held until five years later, when ill-health compelled him to resign. While fulfilling this office he was also made Admiral and Commander-in-Chief of the fleet, in 1768.

Hawke was created a Peer in 1776 with the title of Baron Hawke of Towton, and three years later he retired to a country seat at Sunbury, Middlesex. He died there on 17th October, 1781, at the age of 76 years, and a long epitaph erected to his memory in the Parish Church of Stoneham, Hampshire, records that "the bravery of his soul was equal to the dangers he encountered," and that "wherever he sailed victory attended him."

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
LIVERPOOL 13, ENGLAND.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/– for six months and 16/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 34, St. Patrick St., Toronto.
UNITED STATES: Meccano Co. of America Inc., New Haven, Conn. Meccano Co. of America Inc., 200, Fifth Av., New York.
AUSTRALIA: Messrs. F. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., P.O. Box 129, Paykel's Building, Anzac Avenue, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA: Karachi: Daryanamal and Bros., Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

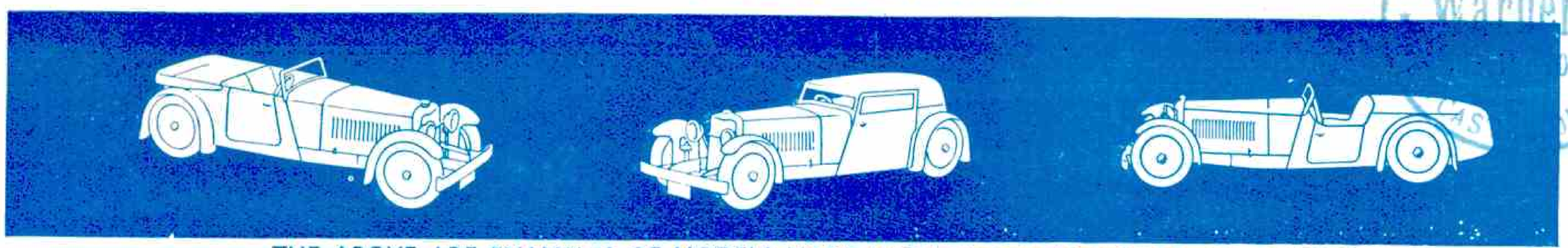
The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

What is Missing?

On the morning following the publication of the June "*M.M.*" we were inundated with entries to the Missing Advertisement Contest announced under the above heading. Quite 95 per cent. correctly indicated the absence of Jenners Ltd., of Edinburgh.

The first prize has been awarded to T. J. Primrose, Chorlton-cum-Hardy. Consolation prizes have been awarded to:—T. S. Ballantyre (Kirkcaldy); F. E. Cox (Cheltenham); W. Eadie (Currie); S. Furniss (Blackpool); J. L. Leeson (Brigg); B. E. H. Mason (Eastbourne); W. R. Parry (Blackburn); R. J. C. Rees (Swansea); N. B. Roberts (Dudley); A. Robertson (Edinburgh); J. Storr (Barnes, S.W.13); J. Wylie (Galashiels).

BARRAS BRIDGE
Warner's
TYNE



THE ABOVE ARE EXAMPLES OF MODELS MADE WITH MECCANO MOTOR CAR OUTFIT No. 1.

MECCANO

MOTOR CAR CONSTRUCTOR

Perfect miniature reproductions of many different types of car can be built with these splendid Outfits, including sports four-seaters, speed cars, sports coupés and others. All the models are fitted with a powerful clockwork motor and a steering gear that functions perfectly. The parts are finished in rich enamel and nickel-plate, the complete Outfits being masterpieces of miniature automobile craftsmanship.

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The motor car models that can be built with this Outfit are the finest you ever saw. Look at the examples illustrated at the top of this page and think of the fun you could have building these and other types equally graceful and realistic.

No. 1 Outfit is available in four different colour combinations—Red and Light Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. It is supplied complete with powerful Clockwork Motor.

Price **14/6**

No. 2 MECCANO MOTOR CAR CONSTRUCTOR OUTFIT

Larger models of a superior type can be built with No. 2 Outfit. They are perfectly designed, beautifully finished and the most attractive examples of constructional engineering ever invented for the delight of boys. Their handsome and realistic appearance may be judged from the illustrations below.

No. 2 Outfit is available in four different colour combinations—Red and Light Blue, Light Blue and Cream, Green and Yellow, and Cream and Red. A powerful Clockwork Motor that gives a run of 150 feet on one winding is included. Price **25/-**

IMPORTANT.—It should be noted that No. 1 Motor Car Outfit parts cannot be used in conjunction with those of No. 2 Outfit.

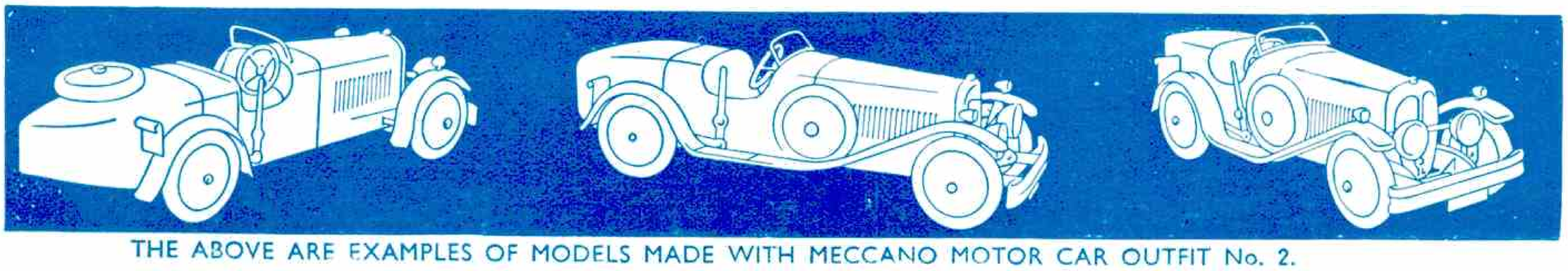
Manufactured by

MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

MECCAUTO 538189

MECCANO MOTOR CAR CONSTRUCTOR OUTFIT No. 1

MECCANO MOTOR CAR CONSTRUCTOR OUTFIT No. 2



THE ABOVE ARE EXAMPLES OF MODELS MADE WITH MECCANO MOTOR CAR OUTFIT No. 2.

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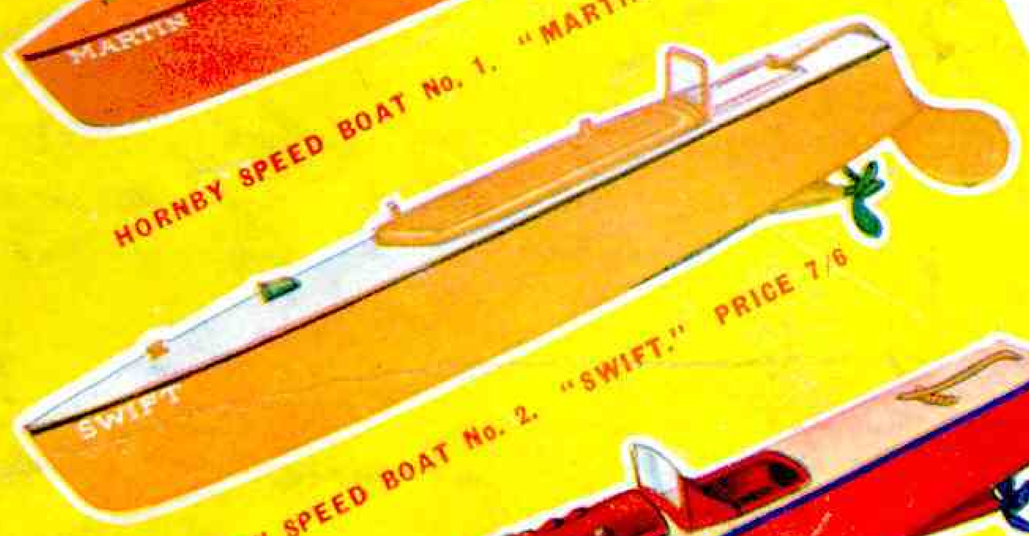
The new 1933 Speed Boats are supreme. Nothing like them has ever been known before in model Speed Boat construction. Each model follows closely the design and general characteristics of the world's famous Speed Boats. All possible skill and ingenuity has been employed in the manufacture of these new Speed Boats. Get a Hornby Speed Boat to-day and be the first to smash records on your local pond!

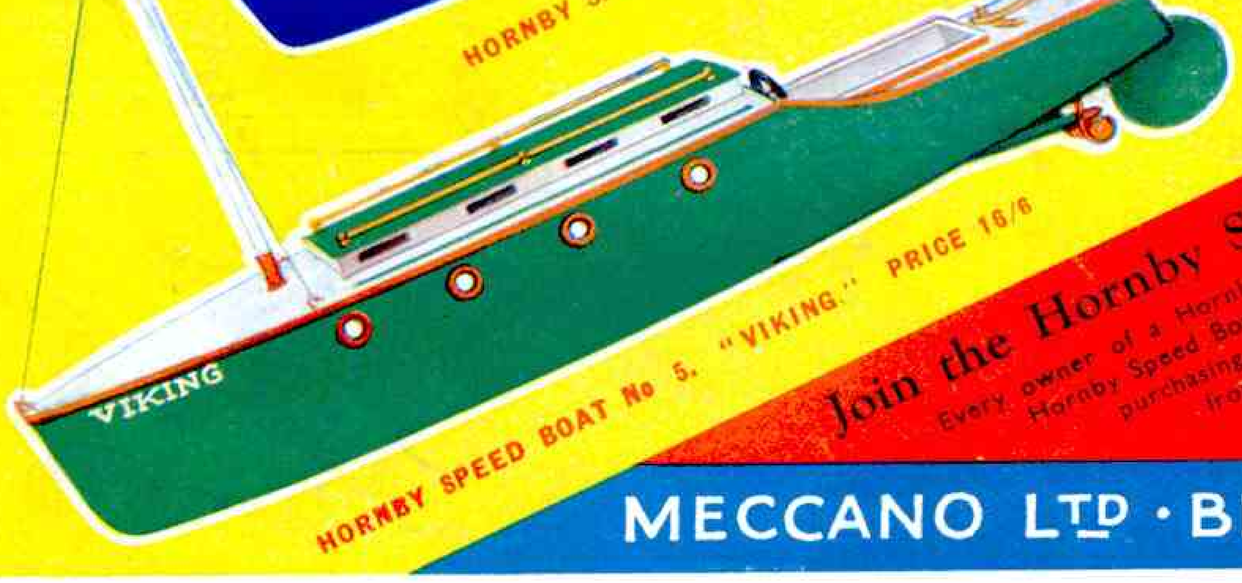
HORNBY SPEED BOAT No. 1. "MARTIN." PRICE 3/11



HORNBY SPEED BOAT No. 2. "SWIFT." PRICE 7/6

HORNBY SPEED BOAT No. 3. "CONDOR," "GANNET" or "CURLEW." PRICE 12/6

HORNBY SPEED BOAT No. 4. "VENTURE." PRICE 15/6



HORNBY SPEED BOAT No 5. "VIKING." PRICE 16/6

HORNBY SPEED BOAT No. 1. A very efficient model, measuring 8½ in. in length and 2⅜ in. in beam. Will travel over 160 feet on one winding. Finished in three different colour combinations—Red and Yellow, Blue and White, and Orange and Green. **PRICE 3/11**

HORNBY SPEED BOAT No. 2. One of the most popular of the Hornby models. Will travel over 300 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Yellow and White. Dimensions: Length, 12½ in. Beam, 3 in. **PRICE 7/6**

HORNBY SPEED BOAT No. 3. Has already established itself as a great favourite. Will travel over 500 feet on one winding. Available with three different names and in three different colour combinations—Red and Cream, Blue and White, and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in. **PRICE 12 6**

HORNBY LIMOUSINE BOAT No. 4. A magnificent model. Will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in. **PRICE 15 6**

HORNBY CABIN CRUISER No. 5. A model of outstanding merit. Will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in. **PRICE 16/6**

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Every owner of a Hornby Speed Boat should join the Hornby Speed Boat Club. This may be done by purchasing a special badge (illustrated above) from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Liverpool 13. Prices: United Kingdom 6d., Overseas 10d., Canada 20 cents.

Ask your dealer to show you the 1933 Hornby Speed Boats

MECCANO LTD · BINNS ROAD · LIVERPOOL 13

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